

WATER GARDENING

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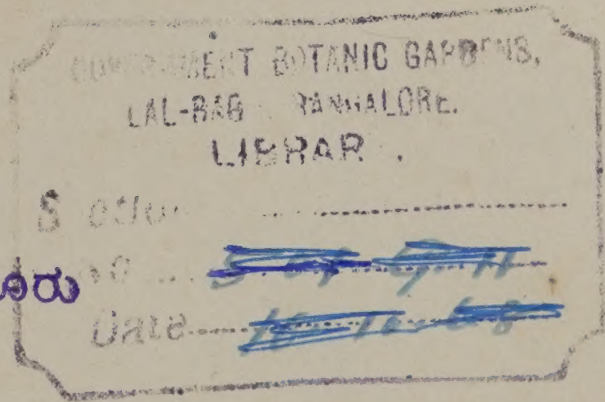
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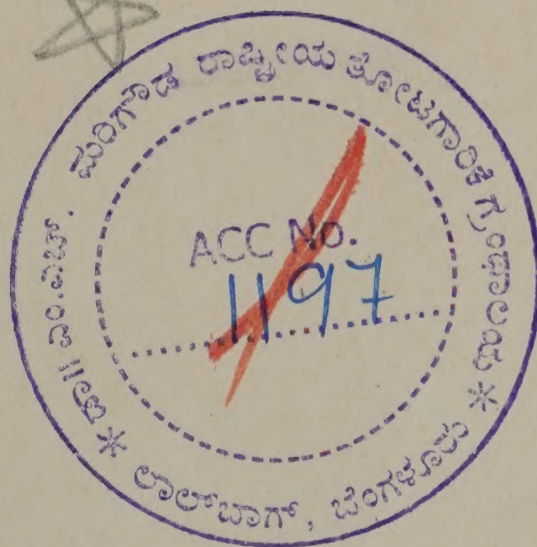
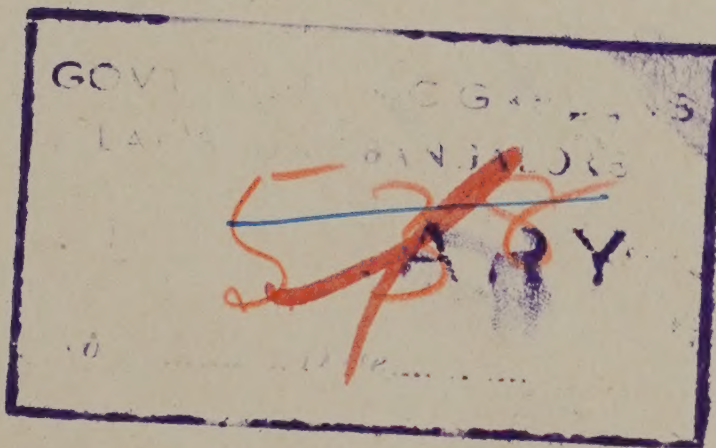
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WATER GARDENING



*Far from the scene of gaiety and noise,
Far, far from turbulent and empty joys.*

HENRY KIRKE WHITE

WATER GARDENING

FRANCES PERRY, F.L.S.

Illustrated from photographs and plans

WITH A FOREWORD BY
E. A. BOWLES, V.M.H.



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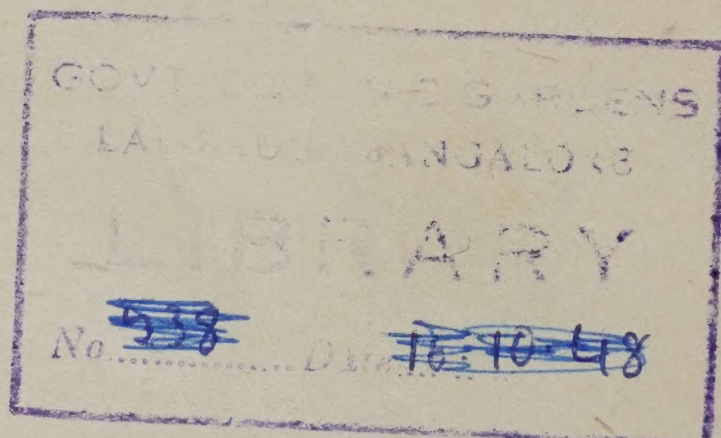
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IN HAPPY MEMORY OF
MARCUS

FOREWORD

AM I PLAYING too much upon fancy when I declare that I find music and magic in the words Water Gardening?

I hope not, because I believe that many others know as well as I do how certain scents and sounds make an echo in that activity of the brain we call Memory. Hold down the loud pedal of a piano and sing any note: the strings in tune with your note will vibrate and echo it.

These words arouse a series of memories for me. I think of water-lily leaves lying flat and cold on the surface of still water, in complete contrast with the upright shafts of reeds or rushes by the bank. The wax-like solidity of the floating flowers so different from the hanging tassels of sedges.

An earlier memory goes back to a summer afternoon and two children who, having exhausted the thrills of reproducing their names in the living green of hastily sprouting Mustard or dawdling Cress, started to dig a pond. By tea-time there was quite a large hole with a floor stamped so firm that we were deluded into believing it watertight.

Though muddier than had been expected it certainly looked like a pond when much labour with water cans had filled it to the brim and we were torn away for baths and bed. Let us pass hastily over the shock of finding that a slushy muddy sediment was all that was left of the water next morning.

Most of us have had like disappointments when attempting to make ponds. Now this is where the Magic comes in. This book is full of it, good white magic of

course, that is to say a power possessed by the writer of knowing how to make matter obedient to our will, and of explaining the right way to go to work so clearly that there need never be another leaking pool.

Excellent illustrations convince the eye that a magic wand is ready to hand for us. Skilfully drawn plans show how easily the wand can be waved, and beautiful photographs of matured work encourage us to shout 'Open Sesame' and possess a water garden of our own. According to our purses and spaces it can be a sunken tub, a cemented pool, a flowing stream, a still pond or wide lake. Even for a London Flat there can be an aquarium for every window.

This 'Hey presto' power of conjuring is ours because the whole book is the result of practical knowledge and wide and careful research in the literature of the subject, and moreover, in the difficult task of ensuring that the botanical nomenclature used in the lists of plants should agree with the latest decisions of authority, even when the correct name is not that of our common usage.

I congratulate author, publisher and readers on the excellence of this royal road to Water Gardening.

E. A. BOWLES

MYDDELTON HOUSE, 1938

PREFACE

WHEN I FIRST took an interest in water gardening the dearth of literature upon the subject was the cause of much disappointment. There was no one volume devoted entirely to aquatics that contained all the plants that I wanted to know about; such information as was desired had to be sought in ponderous tomes in the libraries—sometimes it could not be found at all if the plant was a new one. Apart from *Nymphaeas* and some of the more spectacular aquatics, illustrations were scarce, so that one had no opportunity to visualize or differentiate between the various kinds. The aim of this volume, therefore, is to bring such information between the covers of one book, and to assist garden owners, professional landscape architects, school-teachers and others to make the best of their water garden, and to construct, plant and maintain it in a proper fashion. The descriptive lists of aquatics will be found to include not only those that are at present widely grown, but also many others that are equally well worthy of cultivation but which still await introduction.

For cultural methods I have been privileged to call upon my father-in-law's fifty years' experience with this form of gardening. To him I am indebted for his ever ready help, his keen interest in this work which has been such a great incentive, and for much useful advice and information.

To Mr. E. A. Bowles my gratitude is of long standing. He it was who first helped the small child name her wild flowers and later set her on the path of horticulture. It is my pleasure here to express some appreciation of his many kindnesses and also record the privilege I have experienced in having the free run of his library.

I have to thank the staffs of the British Museum, the Kew Herbarium and the Royal Horticultural Society's Library, and especially Mr. William T. Stearn and Mr. Francis Ballard, for the help they have given in various ways during the preparation of this book; also Mr. George C. Taylor for his valuable advice and criticism during its compilation.

To my brother Mr. Leslie Everett I am indebted for the pool construction plans, and to Mr. F. Austin Watson for photographs and for reading the manuscript of the fish chapter. To Miss Gladys Fiske and Mr. D. C. Ellis I would like to express my thanks for reading and criticizing the proofs, and last but not least, desire to thank my husband Gerald A. Perry for his never-failing help and sympathy which have done so much to lighten the task.

FRANCES PERRY

ENFIELD
July, 1938

PREFACE TO SECOND EDITION

WITH THE launching of the first edition of *Water Gardening* went my fond hopes that it might fill a gap in horticultural literature, and perhaps in some way foster or stimulate the interest of others in a delightful phase of gardening. These hopes have been more than fulfilled and the kindly reception afforded the book has more than compensated for the labours of writing it. I am indeed grateful to those who wrote so generously in the early days of its appearance and the contacts and correspondence made since with fellow enthusiasts have given me no little encouragement.

The present edition has been completely revised in the light of the latest knowledge available, and I am particularly indebted to Mr. G. H. Pring, of the Missouri Botanic Garden, St. Louis, the American water-lily specialist, and Mr. Robt. Trickett, an authority on tropical *Nymphaeas*, for their valuable help with and suggestions for the chapter on tropical water-lilies. The methods of cultivation advocated here are those that have been tested over a long period and found to be of proved value.

The growing of water plants is a comparatively new feature in gardening. From the infant stage of the 1920's, when lily pools were things you saw only at shows or in the larger gardens of the country, the child has grown strong and vigorous, so that to-day innumerable ponds are scattered throughout the country. I look to the day when it grows to lusty manhood and every educational establishment, estate and garden has an aquatic feature. As a source of material for fostering interest in Nature Study in schools, the pond has no peer—it is not beyond the powers of the older children to build their own, thus combining the pleasures of construction with the aesthetic beauties of the whole. I commend this suggestion to the teachers of gardening in our schools: I am sure they will derive both pleasure and profit from its adoption.

Here then is the second edition of *Water Gardening*: may it prove of some help to all those who, like me, think the water-lily one of the fairest flowers that blows.

FRANCES PERRY

BULLS CROSS COTTAGE, ENFIELD

1947

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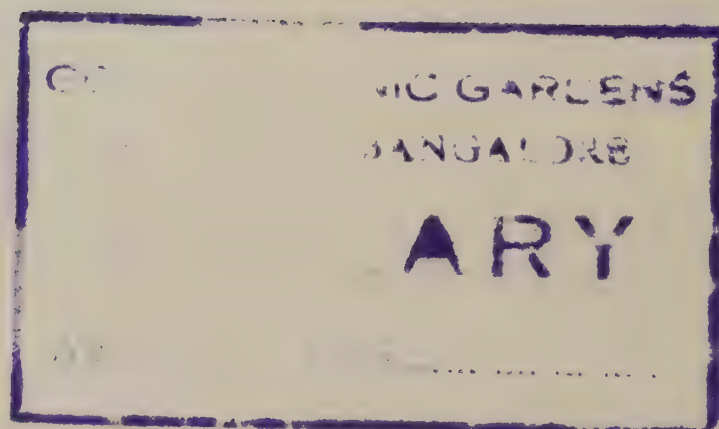
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CHAPTER I

Introduction

EARLY HISTORY—WATER GARDENING IN ENGLAND

IT is generally conceded that life in the world began in the water and from thence spread to the land. How vegetable life originated, from what source it derived its first beginnings, these are mysteries science has never fathomed: and yet since the earliest period of time it has never, as far as we know, been absent.

Water plants are so happily situated that to a certain extent heat and cold, floods and droughts, fair winds or foul have no meaning for them, and they live a life of contentment and luxury. Under such conditions they thrive and multiply, reducing life to the simplest and dispensing with almost all of the appendages of the higher types of flowering plants. A typical example of such degeneration of structure is disclosed in *Wolffia*, which is leafless, rootless and almost flowerless: but carries on the function of life by the budding of its tiny green fronds. In this respect, its biological history is on a par with that of the algae—the lowest form of vegetable existence.

The dependence of animal upon plant life for food proves that the latter flourished first, so that the presence of Brachiopods, Trilobites and Worms in the Neolithic Period indicates the even earlier existence of plants. That much of this is in the transition stage, from aquatic to the more highly developed flowering plant, is proved by the heterophyllous foliage of *Proserpinaca*, *Ranunculus aquatilis*, etc., and shows that evolution is still taking place to-day as surely as it has done in the dim ages of the past.

Fossils of *Marsilea*, *Pilularia* and Characeous fruits are found in great quantities in the lower chalk and tertiary formations, and these would appear to be the first fossil aquatics after the algae. Indeed, it was not until the Pliocene period, when the earth cooled down after the Miocene Age—with its luxuriant, sub-tropical vegetation—that the first true water plants, in a state that we can recognise, made their appearance. Amongst them *Caltha palustris*, *Menyanthes trifoliata*, *Lycopus*, *Sparganium* and *Eriophorum* are known, and have proved their existence prior to the

Ice Age, which destroyed and interrupted the evolutionary process of so much of our flora. Pre-Ice Age remains of tender water-lilies have been found in Europe, the same forms that persist to-day in several thermal springs; but being more advanced in development they are less common than the simpler plants.

HISTORY

As far back into the history of man as it is possible for us to trace, we find certain plants, selected for their artistic or economic merits, and treated with honour and respect. Professor Goodyear in his *Grammar of the Lotus* ascribes to that plant a high place in the arts of thirty centuries before Christ. From its twisted sepals he traces the Ionic capital and from that the Greek fret or meander. This, doubled again, gives the swastika—earliest of all symbols. Representing light and dark, good and evil, male and female, death and life, it is portrayed on old Egyptian ornaments, on pottery and on many of the temple façades. The old figure of the cornucopia—emblem of fertility—is doubtless derived from the well-filled seed pods; whilst the triangle of the calyx is considered to have served—like the shamrock—as a text for those who expounded the Trinity.

Plants furnished magnificent ornaments with which to crown the heads of gods and kings, so that many representations of lotus and papyrus are found in the temples and tombs, the lotus typifying Upper Egypt and the papyrus Lower Egypt. The flower is often found in the mummies of females, placed there to represent regeneration and purification: whilst many of the gods clasp a spray in their hands. The use of flowers in funeral arrangements seems to have been common during the XIXth to XXIst dynasties; wreaths and circlets were laid on the breast of the corpse, until the sarcophagus was completely filled with these floral tributes. Flowers of *Nymphaea coerulea* have been found buried with the mummy of Rameses II, and those of *Nymphaea lotus* in the tombs of many other notable and certain minor dignitaries of these dynasties, dating back from 1100 to 2000 B.C.

Schweinfurth in *The Flora of Ancient Egypt* (1883) states that the wreaths of Amenhotep are probably older than the Trojan wars, but that they were as perfectly preserved as any herbarium specimen and easily soaked out in water. Specimens from these tombs may be seen in the British Museum; it is interesting to note

also that Schweinfurth was unable to detect any material difference between these flowers and the *Nymphaeas* growing in Egypt to-day: proving that the climate of that country has changed little during the intervening lapse of time. The ancient Egyptians were very lavish in the use of flowers, and ornamented their temples and houses most extravagantly. According to Wilkinson, at a nobleman's reception it was the custom, after the ceremony of anointing, to present each guest with a lotus flower, which he continued to hold in his hand when entering the reception room. Servants placed garlands of flowers around his neck or on his head, and a single bud of lotus or a full-blown flower was arranged in such a way as to hang over the forehead.

The cult of the lotus has followed the spread of Buddhism across India to the far boundaries of China and Japan; for it was in the consecrated bosom of this plant that Brahma was thought to have been born. By its peculiar organisation, the lotus is practically self-productive, hence it is looked upon as the 'emblem and cradle of creative power'. Reference to the plant frequently occurs in the ancient Sanscrit literature; in Carli and Elephanta numerous representations are made of it in religious symbols and architectural ornaments.

In China, the goddess Shingmoo, corresponding to the Greek Ceres and Egyptian Isis, is portrayed with a flower in her hand, and the divinity Puzza is represented seated in a lotus. The Chinese consider the blossom symbolic of purity because it is undefiled by the muddy waters in which it grows. In Japan, with flowers of the Motherwort (*Leonurus Cardiacæ*) it is often carried aloft in vases before the body in funeral processions.

ECONOMIC VALUES

Aquatic plants were also cultivated for medicine and for the food value of the starchy tubers, especially those of *Nymphaea* and *Cyperus Papyrus*—which are eaten to this day. The taste of *Cyperus* root is reputed to be comparable to that of potatoes and to form a passable substitute for coffee. The plant covers acres of inundated land along the banks of the Nile; ancient superstition held it to be abhorred by the crocodile, so that boats were (and still are) made from it. It is supposed to be the bullrush mentioned in the Bible, from which Moses' cradle was fashioned: and it furnished the first writing paper—papyri—known to the world.

The method of procedure employed by the ancient Egyptians was simple. The stems were peeled, and the pith cut lengthways into thin strips which were then laid side by side. These were sprinkled with gummy water—some authorities say Nile water—and a heavy press applied to stick them tightly together. The whole made a broad sheet, which after drying was cut to the requisite sizes. Incidentally, Mr. Syngé, in that interesting book *Monuments of the Monks*, refers to the economic possibilities of this plant for the papermaking industry of to-morrow.

EARLY WRITINGS

Many mentions of aquatics (more especially *Nymphaeas* and *Nelumbos*) are found in early writings. The blue and white *Lotos* water-lilies are mentioned in early Sanskrit literature under the names of *ar pala* and *kamala*, whilst Pickering records that 'it is distinctly figured in the cave-temples of Ajanta, and in other Braminical temples in India'.

Herodotus speaks of the Nile lotuses, whilst Theophrastus tells of the uses to which the Egyptians put *Cyperus Papyrus*. 'They use the roots instead of wood, not only for burning, but they make boats of it and from the rind they weave sails, mats, a kind of raiment, coverlets, ropes and other things. Most familiar to foreigners are the papyrus-rolls made of it, but above all, the plant also is of very great use in the way of food. For all the natives chew the papyrus both raw, boiled and roasted, they swallow the juice and spit out the quid.' And of the Egyptian bean (*Nelumbo*) that it makes good food, 'For the root is strong and not unlike that of reeds, except that it is prickly on the surface, wherefore the crocodile avoids it, lest he may strike his eye on it, since he has not sharp sight.' Of *Nymphaea lotus* he writes, 'The root of the lotus is called *korion*, and it is round and about the size of a quince . . . the inside is white, but when boiled or roasted, it becomes of the colour of the yolk of an egg and is sweet to taste!'

Dioscorides in his *Materia Medica* devotes a whole chapter to the *Lotos*; whilst Pliny speaking of the Egyptian habit of making bread from the seed, mixed with milk or water, says, 'There is not any bread in the world more wholesome and lighter than this, so long as it is hot, but being once cold, it is harder of digestion and becometh weighty and ponderous.'

AQUATIC GARDENING IN ENGLAND

Philip Miller in the *Gardener's Dictionary* in 1731 writes, 'In some gardens I have seen plants cultivated in large troughs of water, where they flourish very well and annually produce great quantities of flowers, but as the expense is pretty great (their insides requiring to be lined with lead to preserve them) there are but few people who can be at that charge!' This appears to be the first direct evidence of the art of water gardening in this country; but it was not until 1786, with the introduction of *Nymphaea odorata* from North America, that a few venturesome spirits seriously essayed the cultivation of water-lilies. The earliest water garden of any repute was at Chatsworth, the home of the Duke of Devonshire. Here it was, in 1849, that the *Victoria Regia* was first flowered in Europe. From this time until about 1860, a craze arose for cultivating Nymphaeas: Hooker, Planchon and Lehmann describe several species, and Robert Caspary commenced his researches into the genus. Looking back through old gardening books, one finds very little reference to aquatic plants, and the advice given is often of a vague and contradictory character. In 1848, the *Gardener's Chronicle*, answering a reader's enquiry re *Nymphaea alba*, remarks that 'the roots of these things may sometimes be had in the nurseries, but they are not usually kept'.

Even that 'Grand Old Man' of the nineteenth century gardens, the late William Robinson, had but a poor opinion of water gardens. In *The English Flower Garden*, p. 200, he says, 'Unclean and ugly ponds deface our gardens; some have a mania for artificial water, the effect of water . . . pleasing them so well that they bring it near their houses, where they cannot have any of its good effects. But they have instead the filth that gathers in stagnant water, and its evil smell on many a lawn.' Your true aquatic gardener knows that by careful and considered planting such dire effects may be readily avoided.

The present century marks an epoch in the art of water gardening, for during that time it has made tremendous strides. Surely, at no period have there been so many pools, such a variety of aquatics and moisture-loving plants available and such widespread interest aroused. Though it is unwise to prophesy, there is every reason to believe that the peak has not yet been reached, for

the water garden is so suited to our climate, its results are so charming, of so permanent a nature, and so simple to maintain, that it will surely become as common and delightful a feature as the herbaceous border or rock garden.

CHAPTER II

Pool Construction

THE SITE

WHATEVER THE type of water garden, formal or natural—tub, pool, or lake—the ideal position for it is right out in the open. The majority of aquatics need plenty of sunshine for successful development; in too much shade they become etiolated, and generally far less free-flowering. Of course there are a few exceptions to this rule, but they form such a small minority as scarcely to merit consideration; moreover it is usually possible to protect these with the overshadowing foliage of taller plants.

Another point to remember is that water-lilies prefer still water; fountains, if erected, should be so constructed that their activities can be restricted at will.

Some care and thought must also be given to choosing a site which is not too near a road, or in any position where there is a possible access of surface water, polluted by the poison of sewage, oil or petrol. The progress of pollution may be gradual and insidious, but it will inevitably reduce what was crystal clear water to a thick and evil-smelling liquid.

Another important factor to bear in mind is water supply. It is a shortsighted policy to construct a pool at any considerable distance from a natural or artificial supply, especially if an equally favourable spot may be found closer at hand. To protect the garden during the most severe weather, some sort of windbreak is beneficial on the north side. This may take the form of a low hedge, a belt of trees or even part of the rock garden. To summarise, the ideal spot for the water garden is an open one, where plants and animal life receive full benefit from the sun's rays, protected from cold northerly winds, and within easy access to water.

THE DESIGN

Having decided upon the location, the next thing to consider is the type of pool, and this may be purely formal and orthodox, with circular or rectangular sides, or quite original. We have

known several very successful attempts made at copying, on a miniature scale, certain of our well-known lakes. The ultimate decision as to shape and size must rest with the individual, who must also decide whether the pool is to be a raised or sunken one. When the surrounding ground is high, so that to approach the water garden one has to descend an incline or flight of steps, then a raised pool breaks the outline and comes into prominence as a distinctive feature of the 'layout'. Further, it has the advantage of entailing less labour during construction, for there is no great excavation involved, and no resultant problem of the disposal of the soil taken out. Its disadvantages lie in the fact that the concrete walls must be made considerably thicker to withstand the extra strain; also the temperature of the water will be less equable than in the sunken pool, the fluctuations between heat and cold, that we sometimes experience during hot days followed by cool nights, having a more marked influence on the contents of the pool.

When, however, the general aspect of the garden is low and the surrounding vegetation low growing, then a sunken pool creates an atmosphere of restfulness, looks much more natural, and affords greater scope for artistic design. Also, by being sunk, it is afforded greater protection during the winter months; whilst the water temperatures remain much more uniform throughout the seasons. Here again we must be fair, and state the disadvantages. The pool's contents are less accessible, so a great deal of stooping is entailed when attending to plant and animal life, and more difficulties experienced in syphoning off the water when it becomes necessary to empty the pond. After heavy rains, too, there will probably be a deposit of silt, small stones, etc., washed down from the surrounding slopes, and clouding the water. This is particularly to be expected in a newly made pool; later on, when the banks become clothed with vegetation, some sort of edging is naturally provided. However, when all is said and done, the sunk pool is the more attractive and it is stronger, for the concrete, consequent upon receiving the extra support of the soil sides, is less liable to crack.

Having decided which type he prefers, the gardener should next consider the shape. Undoubtedly the simplest pattern for the beginner is a square or rectangle; in any case it is unwise for the novice to choose too ambitious a style for a first attempt, especially if he is undertaking the work himself.

The pool may be of various depths to accommodate the different aquatics, or it may consist of a deep central portion and a shallow trough surround, in which can be grown the smaller water-loving subjects. It is quite a good plan to keep the central portion a formal shape, and carry out any informality of outline in the shallow margin. Fig. 1 illustrates this point, the shallow margin will be observed to have a well-defined ridge between it and the pool proper. This is also shown in Fig. 2, where the floor itself is made at different depths. Without this ridge or wall, it would be impossible to keep the soil for each compartment in its proper place; even with baskets, any sediment washing out always drifts down in time to the lowest level.

The position and size of the pond decided upon, the outline should be marked out with wooden stakes (8-inch labels will do quite well for this) from 12 to 15 in. apart. This gives some idea of the intended effect and acts as a guide to further labours.

CONSTRUCTION

(a) *The Foundation.* One of the most important points about any pool is the base, and this applies equally well to the raised and sunken types. The site upon which the concrete tank rests must be consolidated, so that it is really firm and level in all places. When one part of the tank lies on really hard ground, and another on a loose pocket of soil, this soft portion commences to settle into position directly a heavy weight is imposed on it. By the very nature of things, extra pressure will thus be exerted upon the tank at that point: it yields in time with the strain, and an ugly crack appears! Probably more leaky tanks are due to carelessness over this detail than from any other cause.

If the bottom of the excavation is chalky, or of a gravelly or stony nature, then this in itself makes a firm base and concreting operations may be started straight away. With a loose or sandy subsoil, however, it is a wise precaution to form a solid base with clinkers, broken brick, stone or concrete. This layer of hardcore should not be less than 4 in. deep after consolidating.

A clay subsoil, with its general propensity to shrinking and cracking during very dry weather, calls for special attention. A layer of ashes should be evenly spread, and will effectually prevent the cracks being transferred from the clay to the concrete bottom.

(b) *The Depth.* In natural ponds, water-lilies may be discovered

equally happy in water a few inches deep as they are in a depth of 4 to 6 feet. It is all a matter of environment, but in the artificial pool a depth of 12 to 18 in. above the crowns will be found sufficient for most *Nymphaeas*. There are just a few exceptions—the pygmies need only a few inches above their crowns, and some of the stronger sorts, such as *N. alba*, actually flower better in deep water. As a general rule, 24 in. may be taken as a good depth to excavate; this allows for 5 to 6 in. of concrete, 4 to 5 in. of loam and about 15 in. of water. It will be found possible to grow most of the *Nymphaeas* in this depth and quite a number of the aquatics (including the submerged oxygenators). The other water plants are catered for by the raised steps as in Fig. 2, or in the shallow margin surround shown in Fig. 1. This margin should be taken out about 10 in., allowing for 4 in. of concrete, and 3 in. each for the soil and water.

These figures of course are the depths from which one starts concreting; it may be necessary to go a little deeper to get the foundations—everything depends on the nature of the subsoil.

(c) *Levelling*. Many amateurs' ponds are spoiled because the water level differs from the top of tank level. This always gives the pool a lop-sided appearance, and is easily prevented by taking levels before the soil has been excavated and the foundations consolidated.

We will assume that the tank is to take a rectangular form as in Fig. 1, and proceed to drive in four flat-topped wooden pegs at the four corners. Next we drive a stout peg (which we will call the datum peg) at some position near the pool, where it will not be likely to be disturbed during digging and concreting operations. It is possible to use the corner pegs for marking out the water level, but there is a risk of knocking these; besides, it is comforting to know that the datum peg is safely out of the way, and may always be referred to as a 'check'. Drive this peg in firmly, and on it mark the exact level at which it is proposed to have the top of the pool, that is, the water level. For sake of convenience, it is as well to arrange that the top of the peg be of some definite unit of length, say 6 or 12 in. above water level. Now, with the aid of a straight edge (that is, a piece of plain board with good straight edges) and a spirit level, mark the water level (or a point 6 or 12 in. above) from the datum peg to the other four pegs.

(d) *Excavating*. Having marked or settled the levels, the next

step is to excavate the soil to the required depth. If the ground is of a very loose nature, it may be necessary to put one or two boards (usually described as 'planking') with cross struts, to hold up the earth at the sides until the concrete wall is built. It is very unlikely that the strutting will be necessary, but it is as well to bear the possibility in mind. Nothing is more discouraging than, having dug out the pool on one night, to find next day—after perhaps heavy rain—that one or more sides of the excavated hole have fallen in.

Throw any excavated material well away from the hole; and do not bank it up close to the edge, or a certain amount is bound to fall into the wet concrete.

(e) *Materials and Method of Procedure.* In concreting a pond it is never wise to economise with materials, so only the finest Portland cement should be used. Cement which has become damp at any time and has resolved itself into solid lumps is quite useless: although a few hard portions will not matter so much if they are still crumbly and *easily* broken up with the finger and thumb.

The next ingredient is known as the 'aggregate', and may consist of a variety of different materials, providing they fulfil certain conditions. It should be hard, sharp and free from all loamy, organic substances or mineral salts and of a size grading from $\frac{3}{4}$ to $\frac{3}{16}$ inch. Possibly the material to fulfil these requirements may be found in the garden or locally, such as clean gravel; but, if not, a reliable builder usually has something suitable. Crushed stones, broken concrete or slag are all fitting, and may be used with equal quantities of sharp sand. Satisfactory results have been obtained with clinkers or ashes, but we hesitate to recommend their use, because of the danger of unburnt organic materials being mixed with them.

Whatever the substance used, too great care cannot be taken to ensure cleanliness; it is far better to reject unsuitable material out of hand than take a chance of a leaky pool later.

Having obtained the necessary ingredients, measure out on a clean, flat surface a quantity of cement, sand and aggregate in the proportions of 1.2.2. (by volume—not weight). Now, with a clean shovel thoroughly mix the constituents by turning them over on to a fresh heap. Do this twice, then add water with a rose-headed watering can. The water should be added gently (not

squirted on quickly through a high pressure hose), and the heap thoroughly turned at least twice more. It is impossible to overmix concrete, but it is very easy to add too much water so that the heap has the appearance of being mixed, whereas in reality it may not have been mixed at all. Just add sufficient liquid to absorb all the cement, then test the heap by thrusting a shovel into its midst, and drawing it towards you with a series of jerks. This action forms a succession of smooth ridges, which should be plastic enough to retain their shape, without settling back into a sloppy mess.

The concrete is now ready for use and may be placed to the required depth over the floor of the pool. We repeat that it should be *placed* in, not thrown in haphazardly from a distance of several feet; for, if this is done, the larger portions of the aggregate tend to drop to the bottom, thus partly defeating the object of the careful mixing.

Begin concreting from one end, working the preparation well in with the shovel so that no spaces or air-holes are left, and pay particular attention to the corners. It is a good plan to lay brown paper over the bottom before filling in, thus preventing pieces of soil from getting mixed with the concrete.

If possible, mix enough of the preparation to cover the whole base at one operation; it gives a smoother finish and is less likely to cause trouble during bad weather. The application of several layers of cement invariably gives an uneven floor, and if the mixture is at all weak the pond becomes porous. This may not be apparent during warm weather, but directly frosts appear these pores widen and the pond begins to lose water. It cannot be too firmly stressed that a leaky pond is very difficult to repair; every precaution should be taken to ensure a watertight job right from the start.

After the mixture has been placed in position, smooth over the surface (to a point 18 to 20 in. below the levels marked on the pegs), with the back of a spade. To form a junction for the walls, before the concrete is quite set, scratch and mark the surface to a width of about 6 in. around the sides; thus leaving a rough face to facilitate the joins. Cover when finished with wet sacks, particularly if the weather is hot, to retard the action of drying; never carry out concreting operations during frosty weather.

(f) *Reinforcement.* Whilst this method of procedure may safely be adopted when constructing a small pool, yet if the

excavation is exceptionally loose or the pond a large one, then some form of reinforcement should be introduced before all the concrete is applied. The best place for this material is about 2 in. from the bottom. To achieve this object, lay about 2 in. of the concrete, then the reinforcement, and finally the remainder of the concrete. This must be done expeditiously, so that the bottom has no chance to set before the top is laid; bear in mind, concrete starts setting in about 20 minutes. When applying reinforcement, always leave a sufficiency, turned up at the edges, to cast into the walls. See sketch 9.

There is a substance on the market for reinforcement purposes, known to the building trade as B.R.C. fabric, but ordinary large-mesh galvanised chicken wire will be found almost as easy to handle. Old scrap metal such as wire bed-springs, or iron rods, are also suitable, providing these are laid evenly and good lap-overs allowed at the joins. Rust on the reinforcement is no detriment, but painted surfaces should be avoided, or the concrete will not adhere to the metal. Small mesh wire-netting is unsuitable: it may form a weak vein owing to the impossibility of the concrete's being properly worked through and around it.

(g) *Shuttering*. Directly the base is dry, the wood boarding or 'shuttering' which will form the temporary supports for the concrete sides can be placed in position. This is formed of sufficient joined smooth boards, not less than an inch thick, to cover the inside face of the concrete walls. The two end boards should be two inches shorter than the actual pond measurements, so that they fit between the side pieces and are secured with wooden battens so as to form a bottomless box. See Fig. 5. These must not be fastened too firmly: remember that the shuttering has to come out again afterwards! Providing the sides are not very long, no further supports should be necessary, but as a precautionary measure insert an intermediate strut between the sides, to prevent their bulging when the concrete is filled in. To avoid the latter adhering to the boards, give them a thin coating of oil or soft soap: they will then come away quite cleanly.

Carefully dust and soak with water the part of the concrete floor which will come in contact with the walls and keep this part free from oil or soap, then work the mixture down into the space between the earth and shuttering. Push it down firmly, but not so vigorously that portions of earth at the side become detached.

Once the concrete is thoroughly hardened, normally in about three days, prise out the corner battens and the side boards should be freed with a slight tap. The shuttering for the shallow trough-surrounds is carried out in an exactly similar way.

Concreting when the sides are weak. When concreting a pool where the earth sides are weak, it will not be advisable to erect the shuttering in one piece as previously described. The same principle will apply, but the 'shuttering' and concreting must be done in sections, raising 9 or 12 in. at a time so that the lower portion of concrete is set before the planking is removed.

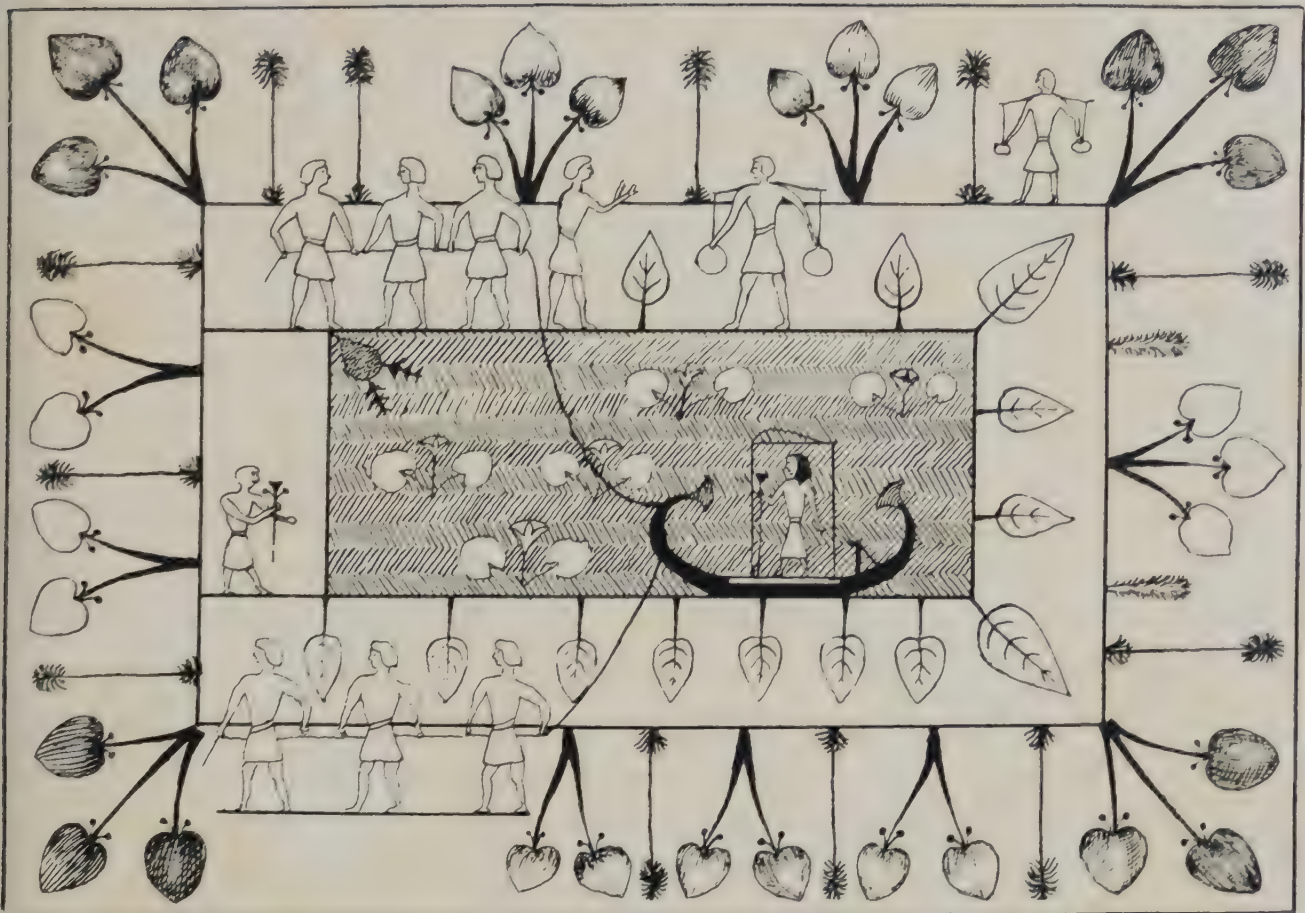
The top of each section must be left rough each time, and thoroughly soaked with water before another layer is added.

Concreting under Water. Sometimes, when the excavations are finished, the pond tends to collect water which lies in the bottom. If this gets very deep, it will be necessary to resort to pumping or baling before the concreting is commenced, but a matter of a few inches need make little difference, as surprisingly enough, concrete sets just as well in water as in dry positions. If water is present, however, be more than usually careful not to throw it in, but lower the mixture gently into position, to prevent the cement from being washed away from the aggregate.

(h) *Finishing the Surface.* In the ordinary way no other finish than that left by the concrete is necessary for the inside of the pool intended for water plants. Occasionally, however, when there will be only a little vegetation in the water, and the pool is designed rather as a setting for ornamental fish or a stone fountain, then some sort of surfacing may be considered of advantage. There is a variety of ways of doing this, the simplest being to apply what is known as a 'rendering' of cement and sand, used in the proportions of one and three. This is applied with a trowel in exactly the same way as a plasterer covers the walls of a room.

If a brighter finish is required, the rendering can be done in white cement mixed with silver sand, or with any of the various coloured preparations on the market. These can be obtained ready-mixed if desired, and require only the addition of water before applying. The walls can also be tiled with any of the different tiles or vitreous slabs now in vogue.

These more elaborate finishes, however, are better entrusted to an expert, and it is very questionable whether they are worth the trouble and expense, unless in exceptional cases. The walls of a



A MURAL PAINTING DEPICTING A BOAT DRAWN THROUGH
A WATER-LILY COVERED LAKE

Thebes. After Wilkinson



G. H. PERRY

PAINTING IN A TOMB AT THEBES SHOWING LOTUS FLOWERS
USED AS HEAD ORNAMENTS

After Wilkinson

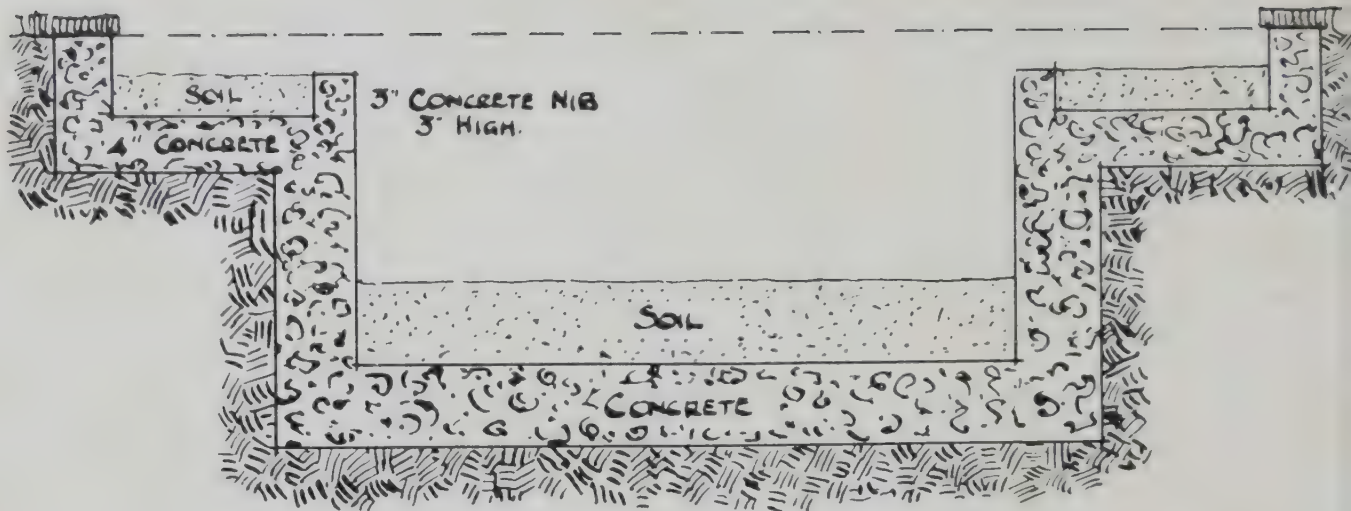


FIG. 1.—SIMPLY CONSTRUCTED RECTANGULAR TANK SHOWING MARGINAL TROUGHS FOR SHALLOW-WATER PLANTING

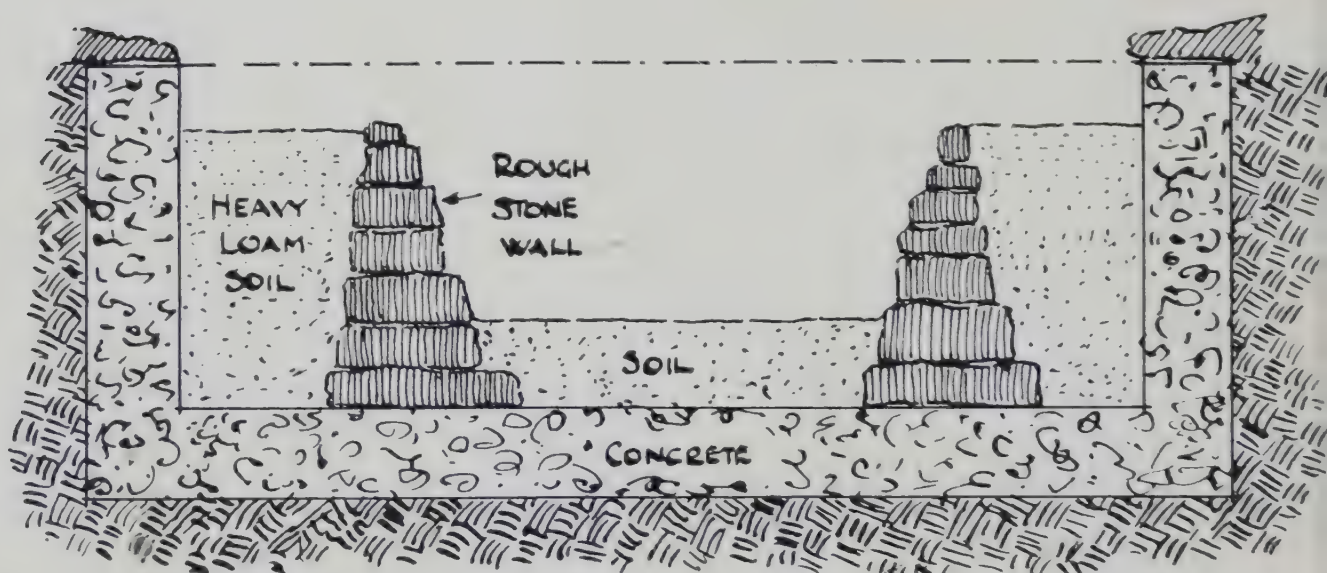


FIG. 2.—A SIMPLE METHOD OF ARRANGING FOR VARIOUS PLANTING DEPTH



FIG. 3.—POOL DESIGNED TO ALLOW OF CENTRAL PLANTING FOR SHALLOW-ROOTED AQUATICS

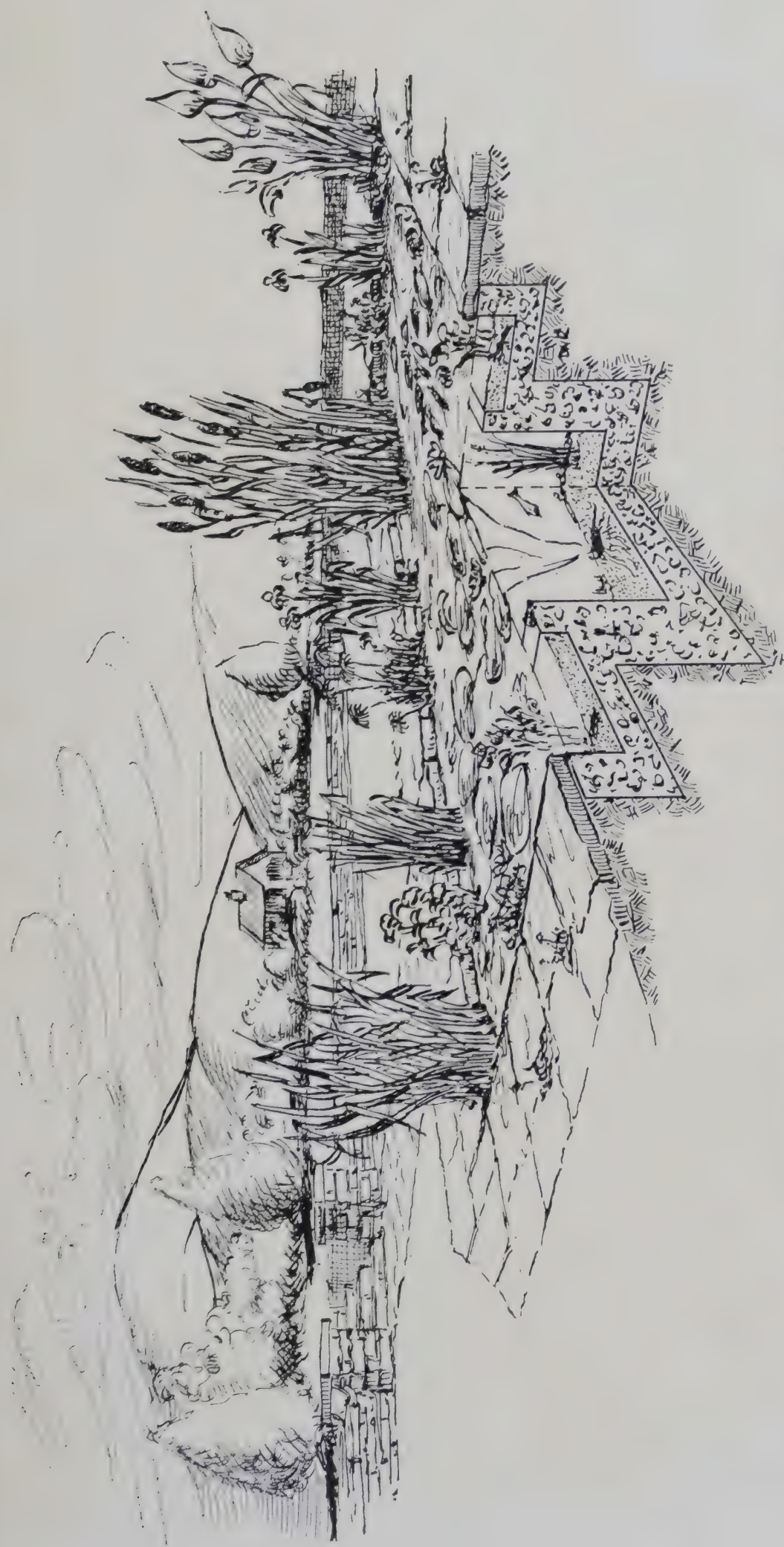


FIG. 4.—SECTION OF A COMPLETED POOL SHOWING VARIOUS PLANTING DEPTHS
AND MARGINAL TROUGHS

SHUTTERING.

CONCRETE TROUGH

CONCRETE SIDE OF POOL

CONCRETE BOTTOM OF POOL

SHUTTERING STAYS

PLANKING

STUTTING

EARTH CUT AWAY TO SHOW PLANKING AND STUTTING

CORNER CUT AWAY TO
SHOW CONSTRUCTIONAL DETAILS

VARIOUS METHODS OF EMPTYING
THE POOL

FIG. 6.—By PLUG.

FIG. 7.—By MEANS OF A STOPCOCK OPER-
ATED BY A REMOVABLE ARM KEY

FIG. 8.—By A STOPPER-NECKED BOTTLE IN-
SERTED INTO THE CONCRETE.

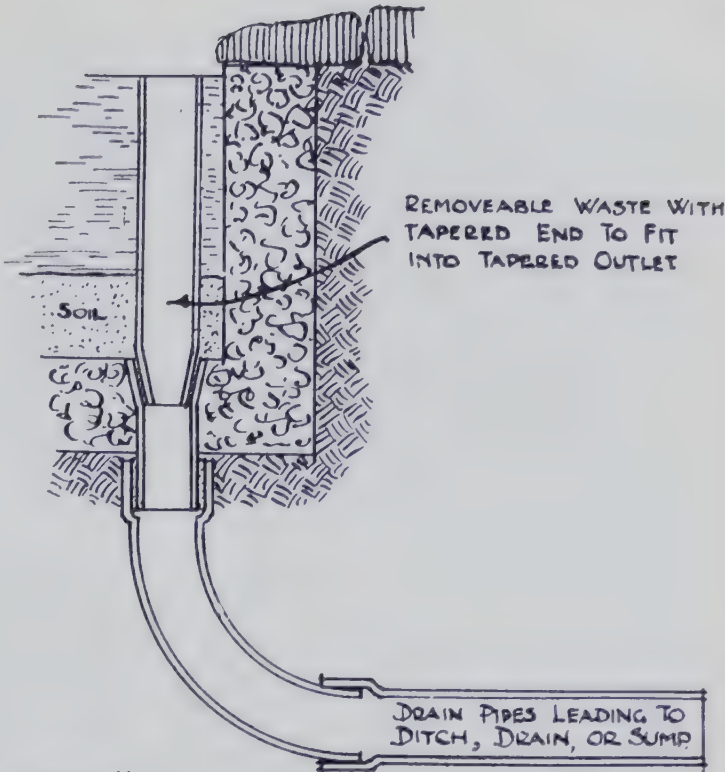


FIG. 6

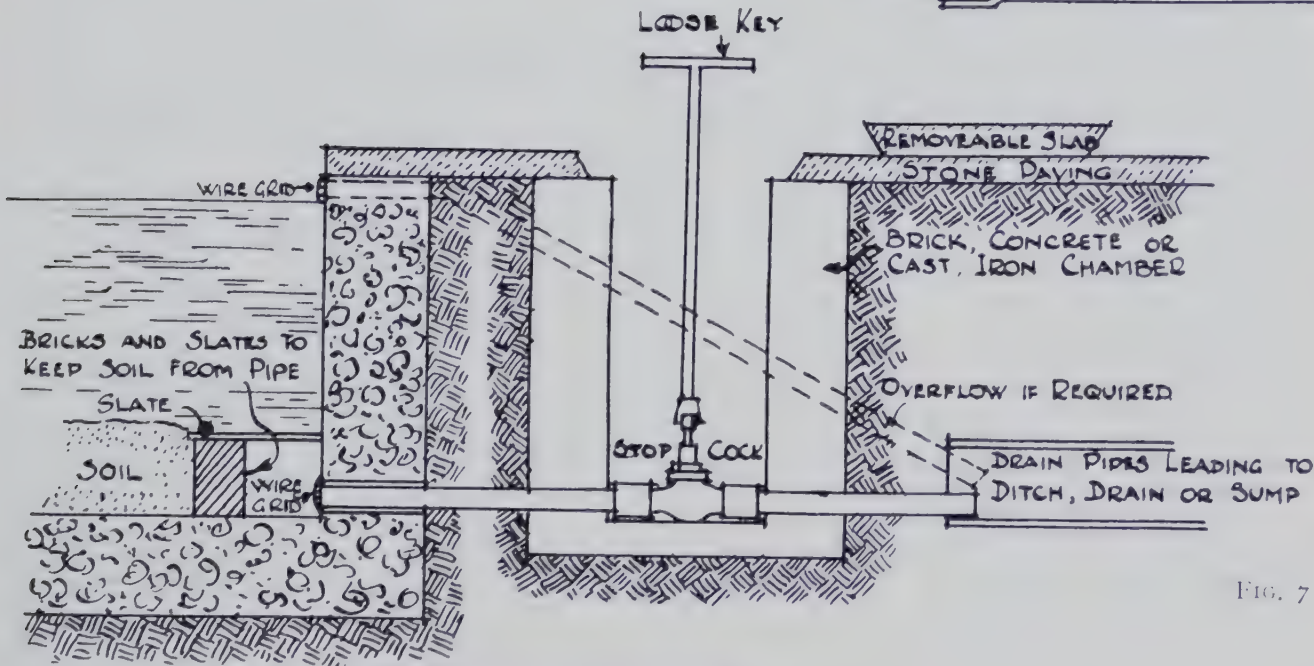


FIG. 7

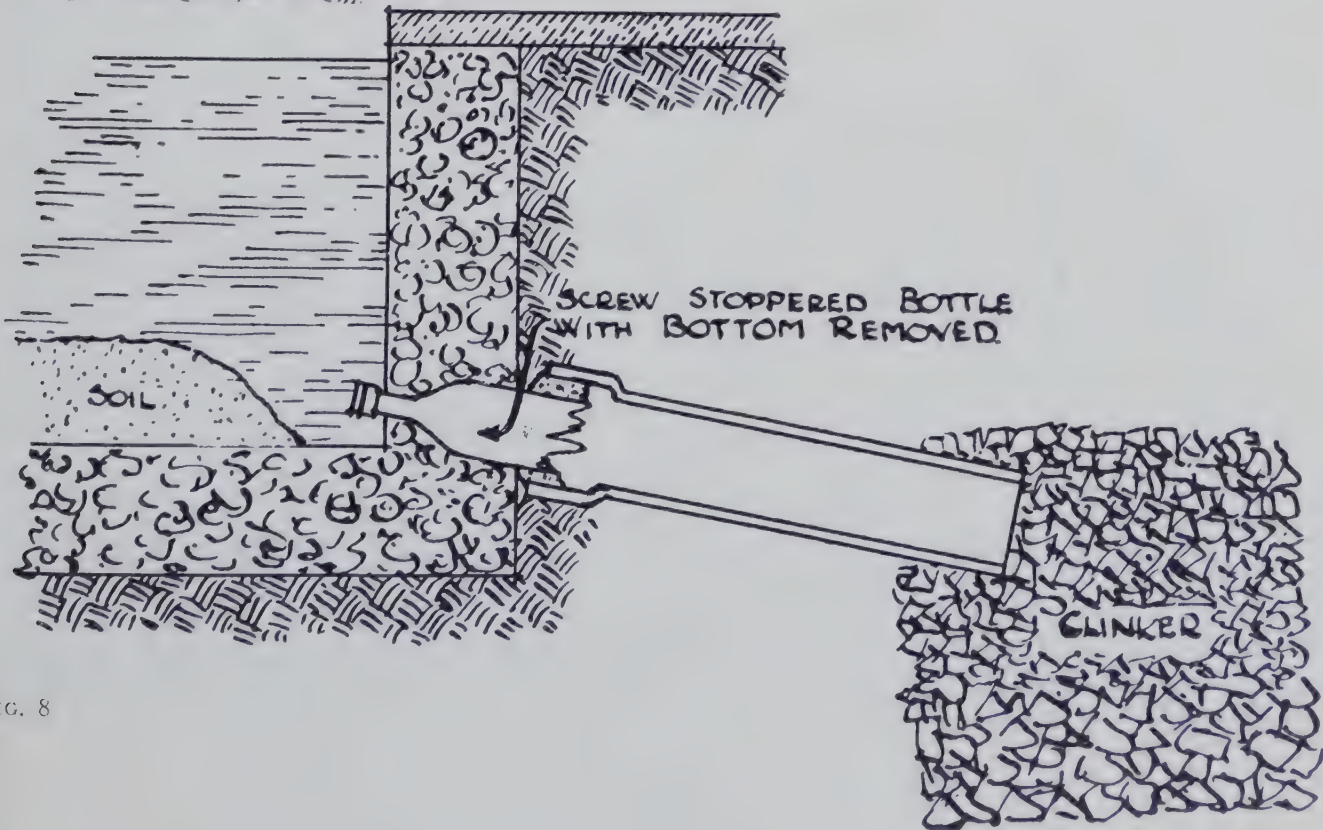
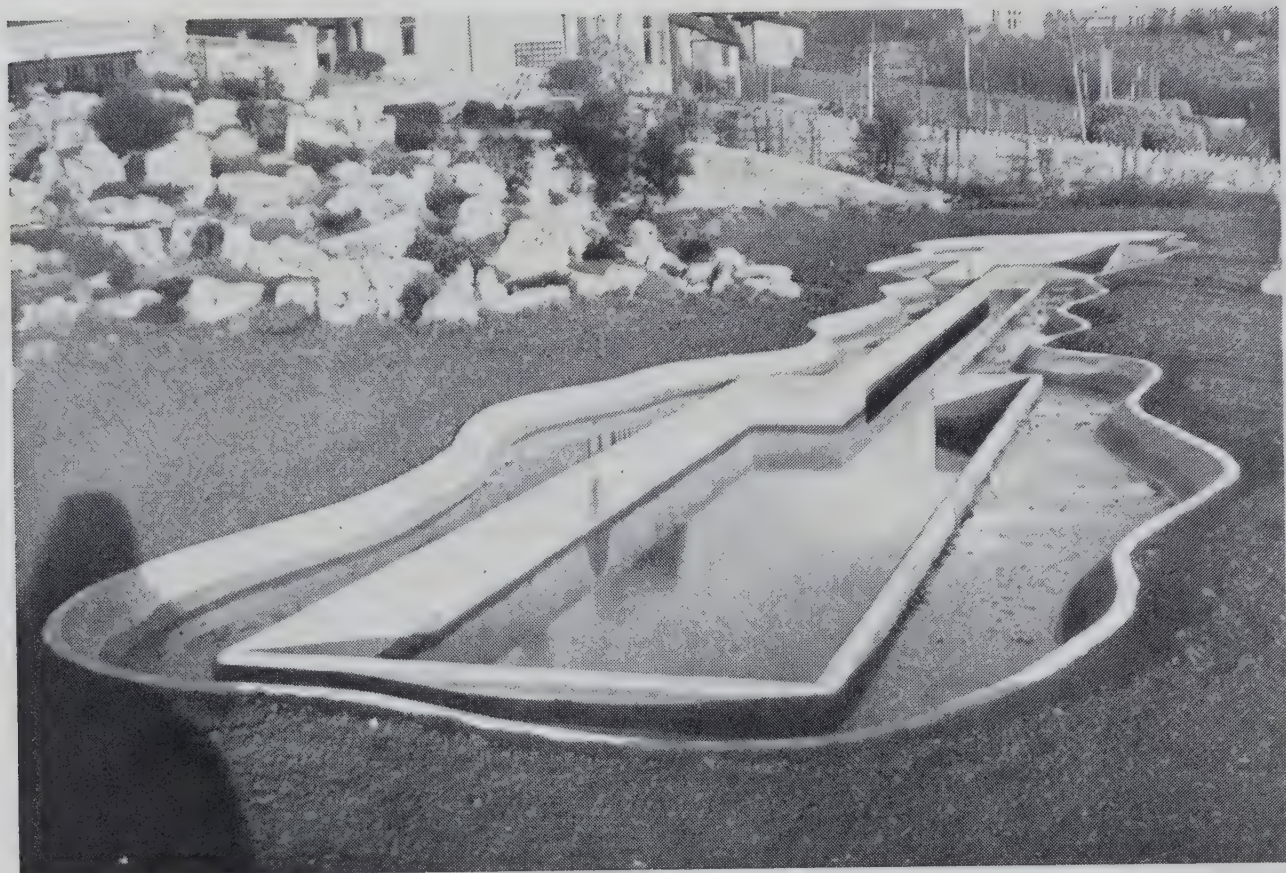


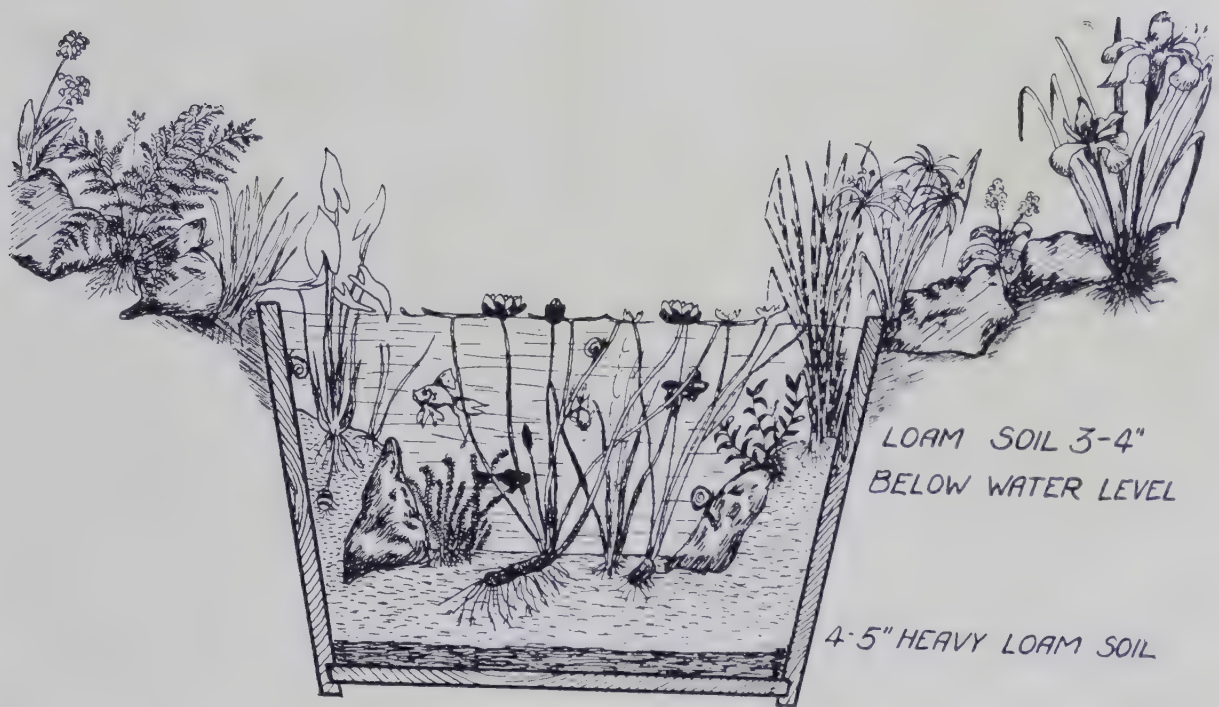
FIG. 8



A NEWLY CONSTRUCTED POOL SHOWING HOW AN IRREGULAR OUTLINE
MAY BE OBTAINED BY MEANS OF A SHALLOW TROUGH SURROUND



THE SAME POOL SIX MONTHS AFTER PLANTING



SECTIONAL SKETCH OF A TUB GARDEN



TUB GARDENS

*A garden should be rather small
Or you will have no fun at all.*

REGINALD ARKELL



TOO OVERPLANTED TO BE RESTFUL: THE NYMPHAEAS WOULD
FLOWER BETTER IF DIVIDED



A FORMAL WATER GARDEN WHICH LOSES ITS SYMMETRY BY IRREGULAR
MARGINAL PLANTING

pool inevitably become discoloured with algae growth; so, unless the tank is constantly emptied and cleaned, the effect of an elaborate finish will be quite wasted.

WATERPROOFING

Special consideration must be given to pools in important positions, as immediately next to the walls of a house, or inside a conservatory, where damage may be caused to the foundations if the pool should leak. Here, in addition to reinforcement, some method of waterproofing the concrete should be used. There are many patent compounds on the market, both in powder and liquid form, which have the effect of sealing the pores in the concrete and rendering it watertight.

MATURING THE POOL

If the pool is constructed during the autumn, and kept filled with water all the winter, there can be little harmful chemical properties left undissolved in the cement by the time the planting season arrives. If tested, the water will be found intensely alkaline, due to the continuous seeping out of free lime from the fresh concrete. It will be realised that this is a state of affairs detrimental to fish and plants alike, so some steps must be taken to counteract its effects, especially when the pool is completed immediately prior to planting.

There are two methods of tackling the problem. The first consists of applying some substance which will completely seal over the concrete—forming a veneer as it were—whilst the second goes to the root of the trouble itself, and aims at counteracting with other chemicals the harmful properties as they dissolve out of the concrete.

For the first plan there are several proprietary preparations on the market: one of these should be painted over the exposed surfaces according to directions, and will completely seal the pores, thus rendering the pool both harmless and waterproof. The only risk lies in the chance of a portion being chipped or broken away; although, even then, such a relatively small area would be exposed that it is highly improbable it would have any marked effect on the contents of the pool.

The second method is quicker, for it consists of filling the pond with water, and adding to this some substance which will

neutralise the alkalinity of the cement. Commercial syrupy phosphoric acid is sometimes used for this purpose, stirring in sufficient quantity to show a slightly acid reaction to litmus paper. The process must be repeated daily, until the water remains acid for two successive tests at intervals of twenty-four hours.

Although there can be no chemical significance the use of permanganate of potash is frequently resorted to to hasten the process of maturing. Its antiseptic properties seem to give some measure of protection, for, time and time again, I have seen freshly made ponds filled with water with sufficient permanganate crystals added to render the liquid wine red in colour. After three days the pools are emptied and planted up immediately. I have never noticed aquatics so treated showing the slightest ill-effects.

EMPTYING THE POOL

Sooner or later, the question of emptying the pool will have to be faced; an unpleasant business at the best of times, it is as well to provide for any contingency, and consider the matter even before need arises.

There are four methods of carrying out the operation:

(1) *By Syphoning*. This method is adopted when there is a lower point outside the pond, into which it is possible to syphon the water. A length of rubber tubing should be filled with water, and the ends pinched together to prevent air access. One end is placed in the pool and the other laid down into the nearest ditch, drain or sump below the level of the pool. On releasing the pressure at the ends simultaneously (this is sometimes a task for two people) the water is gradually syphoned out of the pond. A satisfactory method whenever possible, it entails no special construction. It is as well, however, to run the water through a small hand-net, in case any fish are drawn through the pipe.

(2) *By Baling*. The second arrangement is not so good. The water is baled out by means of a pail or scoop, and disposed of in the quickest possible way. This usually means throwing it over the nearby flower beds, for it is surprising the amount of water a pool can hold, and one very soon wearies of carrying heavy pails any considerable distance. This water slops all over the banks, bringing down silt on to the grass, the stirred-up mud begins to smell; altogether it is a messy business, not to be undertaken excepting as a last resource.

(3) *By an Outlet built into the Pool.* The third method must be arranged for during the construction of the pool. An inch above the soil level, that is 14 in. from the surface of our 24 in. pool, a 'run-away' should be constructed with stoneware or iron drain-pipes. A length of iron pipe is cast into the concrete at this point, and leads to the drain-pipes, which in their turn run down to a drain or ditch. At a convenient point a stopcock is fitted, enclosed in a small brick or stone chamber. This is operated by a removable long-arm key, and the top of the chamber is either finished with an iron cover, or disguised in some way as in Fig. 7, where a loose paving-stone effectually hides it.

In the absence of a ditch or land drain, to which the pipes can be connected, a drainage sump must be constructed. This need be at no great distance from the pool—3 ft. is quite sufficient—and consists of a pit 3 ft. square, dug *at least* 3 ft. below the surface. This hole is filled practically to the top with clinkers, the drain pipe runs into it, and the pit is filled to the ground level with soil.

There are several other ways of fitting the outlet, and a good plumber will often make use of old materials to keep expenses down. During the last ten years at the nurseries, we have devised a very simple outlet, which consists of inserting a screwtop beer bottle into the side of the tank and cementing and concreting round it. The bottom of the bottle is broken off flush with the side, and it becomes a comparatively simple matter to empty the pool, for all one does is to remove the stopper. See Fig. 8. Some sort of strainer should be arranged around the outlet, otherwise small fish, pieces of plant and other floating debris are liable to find their way down and so block the pipe: very important when the drain of the pool is connected to the house drains. A square of perforated zinc suits the purpose, and is easily slipped into position once the stopper is removed.

(4) *By Pumping.* There are also on the market several inexpensive pumps, some of which are intended for working fountains, but which will, when occasion arises, serve equally well for emptying the pond.

ILLUMINATING THE POOL

If specially desired, some form of illumination can be arranged for the pool, although it is our experience that artificial light tends to 'draw' the plants, making them grow far too rapidly. The light

also attracts unwelcome visitors in the shape of dogs and cats; the latter particularly unwelcome when prize goldfish are disporting in its depths.

The usual methods of installing illumination are either by floodlighting the scene with electric lamps set back in suitable positions, or by underwater lighting, arranged during the construction of the pool. Glass panels are let into the concrete walls with the lamps fitted behind them. This is not a task for the amateur, who would be well advised, if he contemplates illumination, to call in expert advice.

REPAIRING LEAKY TANKS

Apart from being a great nuisance, a leaky tank is definitely detrimental to the fish and plant life, for the constant replenishment of lost water destroys that warm, still state so necessary to the well-being of the pool. The temperature of the water is periodically lowered, giving the plants a series of checks and continually disturbing the chemical status.

If, however, the tank leaks, empty the pool as described in Chapter III, page 28; wash the sides and bottom thoroughly, and look for the damaged parts. If these are but tiny cracks, the whole can be given two applications of a cement wash—using cement and water mixed together to the consistency of paste. Apply this with a brush, working it well into the cracks, and allow the first coat to dry before the second is applied. There are also several patent cement renderings on the market, but the use of any substance containing cement entails chemically maturing the pond before reintroducing plants and animals.

Having had much experience with leaky ponds, a preparation we can thoroughly recommend as of service in this contingency is Ganderbak 'Semi-Plastic'. The cracks should be filled as far as possible with this substance, a little at a time. Once this is set, the whole of the pond surface should be treated with one liberal coat, to make the pond perfectly watertight. We have used and recommended this product, and have heard no complaints. Being non-harmful to plant and animals life, stock may be returned to the pool directly the application is dry.

TUB GARDENING

The cultivation of water plants in tubs is becoming increasingly popular, for they are cheaply and easily set up, and take up only a small amount of space. A great deal of pleasure can be derived from this form of gardening, for every plant and fish is easily tended, and their habits and development can be studied close at hand. Whilst certain subtropical aquatics, such as the *Nelumbos* and tender *Nymphaeas*, are frequently cultivated in tubs, it is not with this class of plant that we now propose to deal. These call for special attention and are more fully dealt with on pages 57 and 74.

The best receptacles for tub gardening are old wine or beer casks, cut down to about 20 in. from the ground: those which have been used for soaps, petroleums or any such oily substances should be avoided, unless they can be burnt out. It is very difficult to clean them properly with ordinary washing, and in an unclean state they become poisonous to both plant and animal life.

Occasionally, if the casks are old, or have been allowed to stand about for a time empty, they begin to leak, so that the water level constantly falls. If this leakage is so slight that rainfall rapidly sets it right again, the matter may be ignored, but in the event of a more serious loss some steps are necessary to prevent further wastage. This is simply and effectively met by packing heavy clay into the cracks, smoothing it over with a wet trowel. The tubs should now be completely watertight, and will remain so, unless allowed to dry right out again.

After cutting down the cask, scrub it well with plain soapy water, then choose a bright, sunny spot in the garden for its reception. Excavate the soil to such a depth that 2 or 3 in. remain above the rim, after the tub is lowered into position. This allows for the judicious placing of rocks and some discrimination in planting to disguise the formal edges. Low-growing perennials such as *Mimulus*, Bog Primulas and *Lobelia syphilitica* may be planted between and around these stones, and do much to create the illusion of a larger water garden. It is not a bad plan to sink two or three of these tubs, growing a different *Nymphaea* and keeping a distinct kind of fish in each one.

Having lowered the tub into position, put 4 to 5 in. of prepared soil into the bottom; and, whilst you are about it, a handful of crushed charcoal may be added for its sweetening properties. The

compost must be in a very damp state, and pressed down firmly and evenly. Now everything is ready for planting, but care must be taken not to overcrowd: one water-lily, two or three submerged oxygenators and about two flowering aquatics are all that is needed. Even these should be chosen with care, for too rampant varieties quickly cover the water surface so that it is impossible to see the fish. For the water-lily, any of the Laydekeri varieties are ideal; they are of small, compact growth, free-flowering, scented—in fact everything that makes them desirable in the small garden.

Plant the lily firmly in the centre of the tub, with the submerged and other aquatics (carefully chosen) around it. The water must be added at intervals, only sufficient being put in at the time of planting to cover the crown of the lily. Leave this for several days, then add a little more, continuing in this fashion until the tub is quite full. The operation may take a month to complete, but is definitely worth while, for it enables the temperature of the water to be maintained, and allows the plants to go ahead much more quickly than they would if the tub were completely filled at the outset. See Fig. 10.

INDOOR TANKS FOR TROPICAL AQUATICS

Indoor tanks for tender aquatics are constructed in exactly the same way as the outdoor pools, except that it is more usual to adopt the raised types, because of their greater accessibility. Concrete is the best material to use, although here again, any receptacle which holds water may be used for growing some form of tropical water plants. The construction of a house devoted entirely to aquatics is not necessary, although the embodiment of one or a series of pools in the general layout of the greenhouse conservatory is, perhaps, the most satisfactory way of displaying the exotic charms of the tender water-lilies and Nelumbos. Several of the most beautiful species and varieties can be grown and flowered in stout oak tubs stood on the floor of a warm or cool greenhouse. With the latter, some form of heating must be devised during the early months of the year, from February to June, after which the sun's heat is sufficient. There are four main methods of supplying heat for the indoor pool:

(1) *By Some Form of General Heat.* This is usually planned during the building of the conservatory or greenhouse, and generally consists of a hot-water pipe and boiler system. A socket

pipe, under the pool, runs from the flow pipes which encircle the house, giving the extra degrees of heat—so necessary in early spring. It is possible to fix this pipe on to an existing boiler system, if the latter is of sufficient heating capacity, and to regulate it as desired. Construction costs are low in comparison with other forms of heating.

(2) *By Electricity*. Electrical heating by thermostatic control is perhaps the simplest and safest method of all, for it ensures uniform temperatures, and there is no need to arrange for a heating chamber below the tank. The only drawback is that it is rather expensive to instal and maintain; also the apparatus must be of the finest quality or it is liable to fuse just at the time when you need most heat. British thermostats are infinitely superior to any of the cheap foreign brands on the market, and for this reason alone should be preferred.

(3) *By Gas*. This is still to a certain extent in the experimental stage, but is proving a cheap, clean and reliable method. The initial expense—that of laying it on—is greatest, but afterwards the maintenance is extremely reasonable. As some form of heating box must be arranged beneath the tank, the latter should be raised on a pedestal to 5 or 6 in. above ground level. The spaces between the legs of this pedestal should be fitted with strips of asbestos, with ventilation holes cut at the top. The burners will be placed inside this chamber, so that some form of door should be constructed for easy access. Special burners may be purchased for the purpose, and should be fitted with a tap or thermostatic control. If the construction is efficient, the hot gases from the burner will diffuse right across the base of the tank, so heating a very considerable surface area. As the volume of gas burnt is exceptionally small, there is little likelihood of fumes, and consequently no purpose in installing elaborate ventilation methods.

(4) *By Oil*. This method also entails the construction of a heating chamber beneath the tank, but is more expensive to maintain than the gas system. There are several oil heaters on the market, but in every case only the finest paraffin should be used for satisfactory results.

OTHER FORMS OF WATER GARDENING

Practically any receptacle capable of holding water may be looked upon as a potential water garden. Stone sinks, coppers,

galvanized baths—there are even fabric pools on the market made of rubberized canvas! These are a recent innovation: they look well, and are easily set up, but it is early days to discuss their durability.

Clay ponds and dew ponds are occasionally built in certain parts of the country, and, although tiresome to construct, are quite successful if properly made. A certain atmosphere of mystery surrounds the dew pond: the epithet is thought to be a corruption of *Dieu*—meaning God, for it seems so strange to obtain a supply of water without the aid of spring or rain that country folk supposed God to provide it especially for their needs. It is kept supplied from atmospheric moisture only, and is generally built in a spot which is continually damp, even in very dry weather.

The construction of an artificial dew pond, sometimes called a 'cloud' pond or 'mist' pond, is not a job for the amateur; it is a highly skilled undertaking calling for expert knowledge. A brief description of the method may be of interest.

A shallow basin is dug out of the soil, with a dip at one end and sloping from the sides down to the centre. A layer of coarse straw is next spread all over the excavation, followed by a thick stratum of clay which should be substantial enough to make the pond watertight. Straw, being a non-conductor of heat, does not allow the warmth of the surrounding soil to be conveyed to the clay and so prevents the latter from drying out and cracking. Finally, the clay is puddled and kneaded down into the straw, and then smoothed over to give an even surface.

On summer nights, the dew condenses against the cold clay sides, turns to water, and runs down the sides to the dip at the end. Heavy rainfall will eventually fill the pond, and after that the dew condensations replace any losses from evaporation. Occasionally, the pond is turfed over to prevent the clay from cracking before it is completely filled. Incidentally, the straw imbedded in the thick, underground subsoil, becomes in time as hard and impervious as rock—a factor which probably contributes to the general watertightness. In a natural dew pond, the place of straw is doubtless taken by bracken, coarse grass or heather.

Even those people living in flats or tenement-houses, and debarred from possessing that greatest of treasures—a garden—may know the joy of water gardening, for it is possible to have a window-box designed as a miniature pool. A small, galvanized

tank, about 6 in. deep, which will allow for 3 in. each of soil and water, should be so constructed as to fit the window-sill exactly. Space will be limited, but there are not a few small growing plants suitable for such positions, including the pygmy water-lilies, *Cyperus alternifolius*, *Myriophyllum proserpinacoides*, *Ludwigia palustris*, *Eriophorum latifolium* and others.

It is not generally known that the pygmy water-lilies may also be grown in a fair-sized bowl in the drawing room. In the bowl, which should be 8 or 9 in. deep, and about 12 in. across, place 4 in. of finely rammed, good, sifted loam. Plant the lily firmly in the centre, working a little charcoal around the roots, keep the bowl filled with water and place it in the sunniest position possible. A wealth of small flowers, each about the size of a penny, will be produced throughout the entire summer.

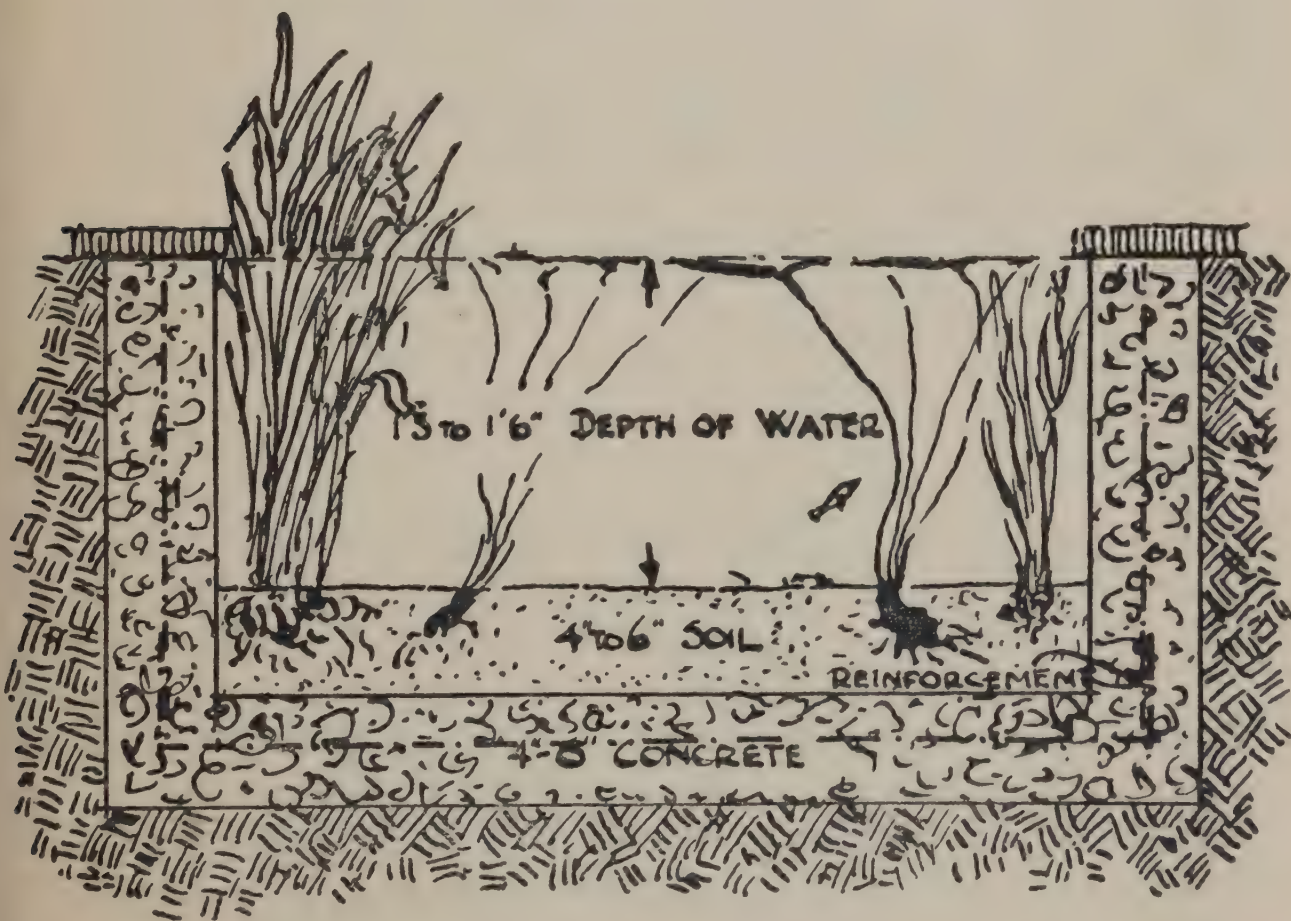


FIG. 9.

CHAPTER III

Planting and Propagation

TIME TO PLANT

THE CORRECT time for transplanting most aquatic stock is in April, May and June: those spring months when plant life is just starting into vigorous growth. We do not say it is impossible to plant after these dates, for we have known stocks successfully transplanted at all times of the year; but there is definitely an element of risk with setting them later. Well-established roots, naturally anchored, are obviously better prepared when severe weather comes. This, of course, applies chiefly to heavily rooted plants such as *Nymphaeas*, *Nuphars* and *Aponogetons*: submerged aquatics can be moved at almost any time with impunity.

Tender water-lilies, *Nelumbos* and other half-hardy subjects should not be planted out until June, when there is not the slightest risk of frost and one may reasonably expect a period of settled warm weather.

PREPARING THE SOIL

Water-lilies make a great deal of growth in a season, and so need a good, rich planting compost if they are to maintain their strength; starvation is quickly made apparent by small, stunted leaves, a paucity of bloom, and thin, meagre growth. For the finest results use the best materials; in this case some good turfy loam (preferably the top spit off pasture land), enriched with cow-manure or coarse bonemeal. The proportion of cow-manure to use is one part to six parts loam, and this makes the finest of all planting mediums, but in the event of difficulty in procuring it, a 32 pot of ground bonemeal to a barrowload of loam makes an excellent substitute. Horse and pig manure are useless for aquatic culture.

Good gardeners make preparation well ahead, so cut the turf in the autumn, and stack it alternately layer by layer with fresh

cow-manure, used in the proportions specified. The heap must be covered as a protection against sun and rain, well turned after an interval of six weeks, and then made into a fresh pile. Repeat this operation at intervals during the winter, so that the heap becomes thoroughly mixed, and the manure rots down without losing any of its substance. When planting-time arrives, the heap may be given a final turn and is then ready for use.

Sometimes it is impossible to make these preparations ahead, in which case a good compost is quickly prepared by screening heavy loam (removing any fibrous material, root, etc.) and mixing with it, in the proportion of six to one, well-rotted cow-manure which has been stacked under cover. Do not use manure which has been standing about outside for a year or so: rain and sun will have destroyed the most valuable properties, so that very little substance of food value remains. If the correct materials cannot be obtained, it is infinitely better to use ground bonemeal instead.

When planting-time arrives, prepare a small heap of screened loam (unadulterated with any manure), to be used as a top-dressing over the other compost. This is a necessary procedure to prevent any of the cow-manure from rising to the surface and decomposing, thus fouling the water and poisoning any fish life.

The lesser aquatics and submerged oxygenators should be grown in pure loam, free of any manures. Avoid using sand or fresh organic substances such as peat or leafmould. During many years spent in growing water-lilies and aquatics, we have tried a number of varied composts, and proved to our own satisfaction that a good rich loam is the finest material for water plants. We know there is some controversy on the subject of using sand and leafmould, but experience has taught us that these quickly become rank and rapidly lose any nutritive value. Sand is an asset in the aquarium, but we consider it out of place in the outdoor pool. Shun, too, old swamp mud or dredgings from river beds; it is entirely without food value, as witness the heaps of mud often seen by canal banks—with not even the commonest weeds flourishing on them.

When preparing soil for seed sowing or cutting pans, use plain loam which has been passed through a $\frac{1}{4}$ -in. sieve, mixed with a little crushed charcoal. The latter helps to keep the water sweet—a necessary precaution when there is little root action.

PLANTING

There are three methods commonly employed when planting water-lilies, any one of which may be adopted.

The simplest way is to plant them straight into baskets or aquatic pans (which have holes bored at intervals around the sides), dropping these into the required positions in the pool. This plan finds favour when large areas of water are under consideration, or in natural ponds difficult to empty. Sometimes the owners of small pools plant their lilies in baskets, and top-dress the soil with an inch of well washed shingle. This they do to prevent the fish delving into the soil and clouding the water.

Nevertheless, it is a method we do not advocate unless there is a natural mud bottom, into which the roots will eventually penetrate; or unless the owner is prepared to repot his plants every three years or so. A vigorous water-lily rapidly exhausts available food material in a small receptacle, and if there is no room for expansion, becomes in time weak and starved.

The second method of planting, by strapping the lily between turves, we have seen employed with considerable success in natural ponds. Cut the turves about 9 in. wide, 12 in. long, and 5 to 6 in. thick, and shave the grass down close to the ground. Sandwich the water-lily between two of these, leaving the crown just exposed, and bind the bundle firmly but not tightly with $\frac{1}{2}$ -in.-wide linen draper's tape. This is better than string, which is apt to cut the turves. Great care must be taken, when lowering the bundle into the pool, that it falls into a vertical position.

Whenever possible, employ the third plan and plant straight into the soil base of the pool itself. All the water must be syphoned out, and 3 to 4 in. of our prepared compost spread evenly over the bottom. On this place 2 in. of pure loam from the second heap; let all the soil be in a fairly moist condition, and ram it down firmly to prevent the soil rising when water is added. Now plant the water-lilies, submerged and other aquatics straight into this, just leaving the crowns exposed and with the roots well spread out. Water plants must always be more firmly set than terrestrial plants, for the action of water rapidly loosens badly secured roots, and it is most aggravating to find them floating on the surface next day.

As the rootstocks of water-lilies differ so much in appearance

in the various groups, the novice is often at a loss to know the correct way to set about planting. The *odorata* and *tuberosa* forms have a long, fleshy rhizome very like a bearded iris, and should be set horizontally under an inch of soil, with the crown (from which the leaves appear) just exposed. The Marliacea group, with large, rounded tubers and fibrous roots, should be set vertically, the roots spread well out, and only the crown left exposed.

If any doubt is felt as to whether the planting has been done firmly enough, a few large stones may be placed around the crowns and left there until the roots have made good growth.

Nelumbos must be placed horizontally in a rich compost and barely covered with soil; care must be taken not to break the growing point of the tuber, or the plant will be rendered useless and might just as well be thrown away.

Submerged aquatics are set up to the crowns, or inserted in slips as cuttings, whilst floaters need only be placed upon the water.

On receiving a consignment of plants, remove any dead or broken foliage and slightly trim the roots; it frequently happens that the original leaves die off when first planted, but this need not give cause for alarm—it is a usual occurrence and new ones will appear in a few days.

ADDING THE WATER

Directly planting is completed, the water may be run in. This is a procedure which calls for the exercise of care and patience. Do not be in too much of a hurry over the operation. A little patience in the first few weeks will bring its own reward later in the season. The plants have already suffered a severe check consequent on being moved whilst active, so the sudden shock of 18 in. or so of cold water (generally straight from the tap) is not going to improve matters. To minimise all risks, run in at this time only enough to cover the crowns, and leave it for a few days before adding more. By continuing in this fashion until the pool is quite full (usually six to eight weeks) the water is added in direct ratio to the growth of the plants, and the temperature does not drop too much between whiles. To avoid disturbing the mud, stand a flower-pot on the bottom, and direct the flow into this. Do not run it in too quickly.

When the pool is already filled with water this plan is not

feasible; in which case the baskets must be raised by standing them on bricks to within a few inches of the surface. Alternatively, they may be stood in a shallow part of the pool until sufficiently developed to be moved to a deeper spot.

PLANT PRUNING

Plant pruning is another operation which should be attended to several times throughout the year, especially during the summer months. Slips of plants frequently break away from the parent stock, and set up a separate existence elsewhere in the pond. These should be ruthlessly eradicated, or they will quickly become weeds and may encroach on their neighbours' territory.

If the leaves of water-lilies cover too much space, they exclude light and air and so prevent surface absorption of oxygen. Remove any surplus foliage, taking it off close to the roots, and cut off the old inflorescences from flowering aquatics, to prevent the too liberal distribution of seed.

REPLANTING

After a pond has been established several years, it is sometimes found necessary to replant it because things are not growing as they should. The usual troubles are starvation and overcrowding, or perhaps the pool has sprung a leak.

In the latter case, if the catastrophe occurs during the winter and the water seeps away rapidly, remove the submerged plants and fish and transfer them to an aquarium or bath of water. The water-lilies and other aquatics may be left in the soil, their crowns protected by a good mulch of leaves; and there they may remain until the season arrives for transplanting. In the event of a slight leakage, make good the loss with fresh water until early spring, when the pool may be emptied of its plant and animal life. Now remove the soil, repair the damage as described in Chapter II, and scrub the sides and bottom with some mild antiseptic solution, such as Condyl's fluid.

The water plants must be overhauled before going back into the pond, so wash them thoroughly and cut out any weak or spindly growth. Strong stock may be divided and the tubers of the water-lilies cut up into pieces, leaving one good crown to each plant. A great deal of the old rootstock should be thrown away; it is only necessary to leave a few inches of tuber to each

crown, and some of the thick, white, fleshy roots can also be removed.

Fresh soil should now be placed in the bottom, firmly pressed into position, and the pool is again ready for planting.

WINTERING, PROTECTION AND PRECAUTIONS

In the early autumn many of our plants begin to die down and rot, fouling the water with decaying vegetation. This alters the chemical properties of the water, disturbing the balance of the pool, and so indirectly upsetting the animal life it harbours. Remove as much of this dead material as possible, and with a fish-net lift out any foliage which has drifted in from neighbouring trees. Keep all receptacles filled to overflowing during the winter months, and in the event of freezing, a hole should be broken in the ice, about 18 in. square, and kept open. This admits air to the water and enables the fish to be fed. Most of our hardy forms of water-lilies will withstand any frost we are likely to experience in this country, so providing there is at least 9 in. of water above the crown, and a 'breathing hole' for the benefit of the fish is kept in the ice, there is absolutely no danger of the plants being frozen. In shallow pools, however, they stand a little more risk, so in very severe weather it is a good plan to protect them by laying boards across from side to side, covering these with mats or layers of straw. Directly the weather turns milder, these must be removed or the plants will start into premature growth.

Alternatively, the receptacles may be drained of water and the water-lilies protected with layers of leaves or moss; branches of evergreen trees such as pine or fir afford excellent additional covering.

Tropical water-lilies and *Nelumbos* must be wintered indoors—cold soon affects the leaves, which die off and should be removed. As the cultural directions and wintering precautions of these plants are in many ways unique, they are dealt with in greater detail in later chapters.

Certain ornamental grasses and semi-hardy aquatics such as *Arundo Donax variegata* and *Thalia dealbata* need slight protection during the winter; this is easily effected in pot-grown plants by plunging them outside during the summer months, and bringing them indoors again before the frosts come. Alternatively, if they are growing outside, the stems should be cut down

to the ground, and the crowns covered with some light material, such as fir boughs lightly piled with straw.

PROPAGATION

(a) *Seed-sowing.* The question of seed-sowing does not often arise with the hardy Nymphaeas, for the majority are such shy setters, it is very rare indeed that one is able to obtain a fertile pod. A few forms such as *tetragona* and *odorata* produce fairly heavy crops, but the enthusiastic gardener must learn to treasure each individual seed; for time and time again the promising pod rots away without maturing a single ovule.

This hardly applies to the tender forms, however, where heavy crops of seed may be gathered annually from many of the species and varieties. The ripening pod should be covered with a little muslin bag, and supported by a tie to a slender stake stuck into the mud. Alternatively, the bag may be secured to two corks which will keep it floating near the surface. Directly the pod bursts, the contents float on the water for a few hours, each tiny seed upheld by a whitish bladder of protoplasm. The advantage of this is obvious, for by being borne away from its parent, the young plant stands a much better chance in the struggle for existence. It will be realised that if the seed is not caught in a bag as described, it must be gathered during the brief period of floating on the water by means of a small handnet. After harvesting, wash the seed thoroughly and spread it out on clean paper to dry. Hardy water-lily seed should be sown immediately after ripening, for its period of germination is most irregular; sometimes it comes through at once, and at other times takes months to 'move'.

Regarding other aquatics, Aponogetons should be sown immediately after ripening; but the majority may be dried in the usual way and sown about February. Shallow pans about 3 in. high should be prepared, and half-filled with sieved loam and charcoal. Smooth over the surface and sow the seed thinly, barely covering it with sand. Stand the pan in a warm spot and keep it filled with water. When germination takes place, the young plants may be pricked out into larger pans or small aquatic pots and 'potted on' as they increase in growth. Lotus seeds sown in a warm place as late as April will make good flowering plants during the same season. Keep them free from insect pests and algae, and in shallow water.



TWO GOOD EXAMPLES OF FORMAL WATER GARDENING



Such sights as youthful poets dream

NYMPHAEA
ROSE
AREY



NYMPHAEA
ROSE
AREY





NYMPHAEA JAMES BRYDON



NYMPHAEA SUNRISE

(b) *Vegetative Reproduction.* The commonest method of propagating hardy water-lilies is by means of the 'eyes' or side shoots found round the base and sides of the tubers. In May the old plant may be lifted, washed free from mud and divided by means of a sharp knife. Each crown should have several inches of tuber attached, and the roots cut back. Surplus leaves should be removed and the root replanted. The smallest 'eyes' will appear as mere bud-growths on the root or tuber; carefully removed and planted in miniature 'thumb' pots of pure sifted loam, they should be stood in a basin with sufficient water to barely cover the crown. A temperature of round 60° – 65° is desirable for quick rooting and the young plants can be potted on as they progress in growth. The secret of rooting nymphaea 'eyes' successfully is firm planting in the barest minimum of soil (hence the tiny pots); the action of water soon sours inactive soil.

Many of the reeds and waterside grasses, the coarser growing aquatics, and boggy subjects, may be propagated in similar fashion, by cutting or pulling the clumps apart. The slips should not be made too small, however, and it is always advantageous to retain a certain amount of root to each piece.

A peculiar method of vegetative reproduction is shown in certain of the tender viviparous water-lilies, e.g. *Daubeyana*, *micanthra*. In the centre of each leaf-blade, where the petiole joins the lamina, a baby plant arises. This appears first as a little dark spot, followed by a few leaves, and eventually young roots grow down into the soil. It is not uncommon for these young plants to produce miniature flowers while still attached to the parent; and very pretty they look. Prepare a shallow pan with some sifted loam, firmly pressed; remove the leaves which have youngsters attached and pin each leaf (with forked pieces of twig) firmly into the soil. Add a little water and the young plant will soon become established, the old leaf turning yellow and rotting away.

An unusual method of vegetative reproduction—for a water-lily—is shown in *Nymphaea mexicana*, where long fleshy stolons thrust out in all directions, and each terminates in a young plant. These eventually root into the soil, the internodes rot away, and the plant sets up an independent existence.

Many aquatics thrust out runners in this way, from the floating *Eichhornea*, and tall *Typhas*—which throw out so many that they become veritable weeds—down to the lowly *Vallisneria*, and

other underwater plants. Plants which choose to spread in such a fashion often become a great nuisance in the small pool, and if planted at all, should have their proclivities in this direction somewhat curtailed. This is easily arranged by planting the roots in a cement pocket or large aquatic pot, where their growth will to a certain extent be under control.

Decodon verticillatus may be propagated by layering. The long wands of this attractive shrub bend over with their own weight during the latter part of the summer, when the tips should be pushed down into the soft mud and held there with a stone or small peg. They will quickly root at the point of contact and may then be severed from the mother plant.

Most submerged aquatics are propagated by means of cuttings. This is a very simple operation, for it is not even necessary to prepare them properly. Simply pinch off, with the finger and thumb, slips 2 to 4 in. in length, and dibble these into pans containing about half an inch of loam and 4 to 5 in. of water. They will root in a few days.

CHAPTER IV

Designing the Water Garden

An unerring perception told the Greeks that the beautiful must also be the true, and recalled them back into the way. As in conduct they insisted on an energy which was rational, so in art and in literature they required of beauty that it too should be before all things rational!

Some Aspects of the Greek Genius

FOR MANY years water has played a tremendously important part in the design and landscape of the well-ordered garden. The reason is not hard to find; for it easily lends itself to artistic treatment. The sparkling freshness, the drowsy murmur of the waterfall and the many beauties of the aquatic and moisture-loving plants add to the interest; making an otherwise mediocre garden one of beauty and charm.

There are two methods of using water in the garden, formally and informally: the first involving the construction of a conventional shaped pool in an orthodox setting, and the second allowing for more specialised treatment and embodying ponds, streams, lakes or waterfalls—as the case may be—in natural surroundings.

The garden owner with a natural stream is indeed fortunate, for he can, by excavation and some careful forethought, extend it into a pool or series of pools; arrange for waterfalls or construct a lake, with miniature islands and bridges. Stepping stones arranged at intervals in the shallow parts of the stream bed strike an unusual note and serve the same purpose as a bridge. The margins of the water can be fringed with bog and water plants, stately ferns or low-growing shrubs—and broken at intervals by little stretches of turf to afford easy access to the stream itself. One should never lose sight of the fact that the water is the main feature of the picture, and should not be entirely hidden by the framework of plants; a fair expanse of bare water should be left, through which one may glimpse—as in a mirror—the darting, scintillating fish and other denizens of the underwater world.

FOUNTAINS

Because we are more interested in the plants than any other phase of the water garden, we condemn fountains; for there never yet was a pool that grew better water-lilies consequent upon their being splashed at intervals by water from a fountain. In certain formal situations, however, they are doubtless desirable. The least objectionable type from the plant point of view is the wall fountain, which lends itself to decorative architectural treatment. In a strictly formal garden, a playing fountain looks cool and refreshing on hot summer days, the jet of water arising from an artistic piece of statuary; but, at the same time, if it be in action during the late afternoon and evening, the temperature of the water becomes lowered at the one time of day when the heat should be conserved. Arrangements should be made for the pool to be slightly larger in dimensions than the height of the fountain jet, so that the grass or stone surround is not continually wet. If the water pressure is not sufficient, there are several pumps on the market which can be installed, and are inexpensive to employ—after the initial outlay—as they use the same water over and over again.

DIVERTING STREAMS AND DAMMING

Where it is desired to divert the flow of a stream, the excavations should be carried out first, so that an exit for the water is available before the construction of a dam commences. This is very necessary, as even a temporary stoppage may involve flooding or drought, causing annoyance and inconvenience to neighbours, through whose land the stream may flow. On the question of constructing a dam it is impossible to generalise, for each individual case must be considered separately and plans made accordingly. In any case, it is not a job for the ordinary gardener, who should call in expert help and advice.

BEAUTY OF WATER USED IN CONJUNCTION WITH

(a) *Grass*. Sweeping lawns running down to the water edge are ideal for the riverside garden, and stand the strain of occasional flooding a great deal better than would any herbaceous plants. Grass is also pleasing by the banks of the streamlet, especially when interspersed with such low-growing moisture perennials as *Primulas japonica* and *denticulata*, *Caltha palustris*, *Lobelia*

cardinalis and the Trollius. A steep slope dropping down to a lake or pond should have its uniformity broken by a clump of bamboos, a weeping willow or some other subject which will advantageously reflect in the waters beneath. Typhas, rushes and lilies should also be introduced—boldly, so as to form good clumps—but not so thickly as to cover all the surface. The grass should be kept short and in good condition, unless the stream runs through woodland or a wild garden.

(b) *Woodland*. Whilst too many trees and shrubs close to the water edge are not to be desired, owing to the shade which they cast, and to the unhealthy conditions set up by their falling and decaying leaves, it sometimes happens that natural woodland is already present in the garden, or that a screen of trees is required to block out an undesirable view. Perhaps, in an exposed position they may be suitable as a windbreak, or again, the garden owner may love trees and want them simply for their own sake.

Whatever the reason, the great thing is to exercise some judgment in planting. They should never be so massed together as to block out too much light, nor so closely that the natural beauty of development of the individual is in any way restricted. It should be possible to wander with ease amongst and around them; therefore open spaces should be left at intervals facing the water, so that each turn of the path will afford fresh aspects or reveal new beauties. Always bear in mind that the water ought not to be shaded from the south or south-east, so that low-growing shrubs or herbaceous perennials should be used at these points.

(c) *Stone*. Rock and water gardening naturally go hand in hand, so that no commendation from us is necessary to stress the appropriateness of that companionship. In such surroundings, however, one must be more than ordinarily careful in the choice of plants; the natural wildlings do not look amiss with the native species of the temperate zones, but the introduction of any of the more exotic or floriferous florist's creations should be avoided.

THE BOG GARDEN

The true water garden cannot be said to finish at the grass verge of the stream or by the concrete margins of the pool. The surrounds should be clothed with such moisture-loving plants as would naturally flourish close to water, and an effort made to obtain a simple and attractive effect. This is most easily done by

constructing a bog garden, in whose lush richness many of our most beautiful plants may be grown to perfection. In the absence of a natural site, a bog garden can be constructed by excavating a foot of soil and making a basin of concrete. Drainage holes should be made at intervals around the sides—about 6 in. from the surface and 3 ft. apart—to carry off the surface water. Another should be constructed at the bottom and fitted with a plug. Next, the bottom must be covered with 5 or 6 in. of crushed brick, slag or any such hardcore, and over this about 18 in. of good loam. Bog plants, as a general rule, favour a vegetable soil, so a liberal supply of horticultural peat and leafmould should be incorporated with the compost. Lime should only be added to suit individual requirements. The surface can be raised into uneven mounds and hillocks, and stepping stones laid at intervals. The latter, besides providing a charming effect, facilitate access to the swampy parts. It will be found that a number of plants will thrive better in the crevices between these stones than they would in more open positions. Moisture, rising by means of capillary attraction, will keep the soil in a perpetual state of dampness so long as water lies below—a condition which must be ensured from the slow trickle of a hidden tap, or failing this, from replenishment by hand.

In the case of a very large bog garden it is unnecessary to make the whole area watertight. A series of drain pipes can be arranged to intersect the ground at a depth of about 6 in., running from a main channel through which water should constantly flow. The whole will make an admirable bog, with moist and drier positions in which various plants will flourish.

CHAPTER V

The Hardy Water-Lilies

Waterlilies in myriads, rocked on the slight undulations
Made by the passing oars, and, resplendent in beauty, the lotus
Lifted her golden crown above the heads of the boatmen.

LONGFELLOW

THE WATER-LILY, with waxen petals and delicate fragrance, is by far the most beautiful of aquatic plants. No plant of yesterday, it can trace its ancestry back into the dim ages of time: and always the history of the water-lily reveals a saga of reverence and respect accorded its spotless beauty and dignity of bearing.

The true position of the Nymphaeaceae or Water-lilies in the natural system of classification is by no means clearly determined, for while some afford them the distinction of belonging to the higher class of flowering plants known as Exogens, they are by others delegated to the Endogens. Lindley inclined to the former view, and from paucity of information expressed himself as disinclined to 'disturb existing arrangements'. The question is an interesting one, but further remarks on such a scientific problem would be out of place in a book of this description; for more information the reader is referred to Lindley's important work, *Vegetable Kingdom*.

The genus readily divides itself into two main sections, which in their turn are subdivided into five sub-genera.

Group 1, *Acocarpia*, comprises (a) *Anecphya*, (b) *Brachyceras*; whilst Group 2, *Syncarpia*, embodies (a) *Castalia*, (b) *Lotus*, (c) *Hydrocallis*. The hardy water-lilies fall into the first section of the second group; indeed, it is no unusual thing to find them known by the name of *Castalia* instead of *Nymphaea* in some botanical works of reference.

Water-lilies are widely distributed throughout the world, practically every country furnishing a representative. New Zealand is a notable exception, but India produces a wealth of species unequalled by any other land. The form and habit differ greatly, for whilst some, like our white *Nymphaea alba*, lie flat

upon the surface, lightly moving to and fro with the undulations of the water, others stand erect and solitary, as if reaching to the sun. The majority open their flowers during the day, closing them in late afternoon; but not a few tropical forms wait till the cool evening before revealing their shimmering beauty—suffusing the air with a powerful fragrance, which breathes of mystery and Arabian Nights. The colour varies intensely: white, pink, red, yellow, copper, blue, and purple and all the intermediate shades are found; whilst the foliage may be green, splashed and mottled with bronze or purple markings, green all over, or even of a uniform shade of copper.

The roots of some of the species are intensely retentive of life and will remain out of water for a considerable time without loss of vitality. Monsieur Delile brought back tubers from Egypt which were kept dry for two years, but which, on being planted, immediately started into growth. We have seen water-lilies, thrown out of a pond on to a herbaceous border, looking the picture of health months afterwards. There was no sign of bud or flower, but the foliage appeared stout and healthy, though tougher in appearance than usual.

The rootstocks vary considerably in the types: some are tuberous, a number almost bulb-like; at least one is stoloniferous and others again rhizomatous. A few forms are viviparous, so reproduce freely, and most of the tropicals set seed readily; but the hardy forms are shy fruiters and generally propagated by division.

The majority of the beautiful hybrids which are to-day at our disposal are the fruits of industry of that great pioneer of hardy water-lily culture, the late Monsieur Latour Marliac of Temple-sur-Lot, in the south of France. Marliac was a wizard with the water-lily; he crossed and re-crossed the species and varieties at his command, so that it hardly seemed possible he could know them himself, and the parentage of many became an enigma. He kept his methods secret, and to all intents and purposes they have passed away with him, but he has bequeathed to the world a race of hybrids which will for ever make his name famous, and earn the gratitude of all garden lovers. No one has yet been able to emulate his record, but there are opportunities for the student, for several hardy forms will set seed and should suggest themselves as possible parents.

To hybridise a water-lily, select a bloom that has just opened (this is made apparent by the presence of a tiny drop of nectar-like exudation lying over the stigma), and on it place some of the pollen-laden stamens of an older flower (with a dry centre). Some botanists enclose the bud with butter muslin before opening, so that no insects shall enter and possibly spoil their work. Whilst every precaution is to be commended, the Marliacea forms are self-sterile, so one can afford to take more risks when dealing with these hybrids. After pollination, the flower may, or may not, mature a pod of seed—it usually rots away. If it still persists after a fortnight, however, there is at least a chance; and the precious pod should be secured with a small muslin bag attached to a stick, so that if there are any seeds, these will not be lost. Possible parents, which set seed, are *N. pygmæa alba*, *Brakleyi rosea*, the *odoratas* and one or two of the hybrid forms. The yellows, such as *N. odorata sulphurea*, *Moorei* and *Marliacea chromatella*, would appear barren; and any pollen is generally dried up and useless. It is almost certain that Marliac used *N. mexicana* for his yellow forms. The flower furnishes plenty of pollen, and fruits readily.

The hybridisation of water-lilies is generally so much fruitless labour, and the results far from encouraging. Out of 159 recorded crosses we made in 1927, only one pod set seed, and the offspring was no better, and indeed, not as good as many of the existing varieties.

From 1939 to 1945 *N. Brakleyi rosea* has been much used as a seed parent: it sets a fair percentage of seed and several beautiful new hybrids have been raised from it.

Fasciation is a peculiarity of one or two of the hardy water-lilies, in a manner which would appear unique in the vegetable kingdom. The worst culprits are *N. Ellisiana*, *Marliacea chromatella* and *Gloriosa*. These may bear perfect blooms and leaves for a number of years, and then suddenly stop. Few, if any, flowers are produced; but dozens and dozens of tiny leaves—only an inch or two across—appear floating closely together on the surface. There seems no reason for the transition, and we have never discovered a satisfactory explanation. On examining the root, it will be difficult to define the growing point, so closely are leaves and stems jumbled together. Here and there, a normal-growing shoot may be discovered, and this may be cut out and planted separately. It will not revert to fasciation, at any rate for a long

time. The old root is useless from the grower's point of view, and not worth its place in the pool. The peculiarity is also occasionally apparent in *N. pygmæa alba*, *helvola*, *rubra* and *Marliacea carnea*.

Since earliest times, water-lilies have had their economic uses, and although not employed as much as they were in medicine, still furnish an article of diet to various native tribes throughout the world. The seeds contain starch, oil and protein and are used as food on the west coast of Africa. The natives gather the ripened pods, spreading them out to dry so that the soft parts may rot away, and the seeds be easily separated. With still further drying, the outer epidermis breaks away from the seed, so that the kernels are left intact. These are either boiled whole, or ground into flour which may be mixed with milk or water and baked into small loaves.

The dormant tubers are ground down in the same way, or boiled or roasted whole in the same manner that we do potatoes. They contain abundant starch, mucilage and sugar, which renders them both palatable and nutritive. In West Africa, *Nymphaea cærulea* and *Nymphaea lotus* are most commonly used, as well as *Nymphaea lotus* and *capensis* in Madagascar and *Nymphaea gigantea* in Australia.

The French also employ *Nymphaea alba* in the preparation of a certain kind of beer, and the rootstocks, which contain gallic acid, are used in Ireland—according to Dr. Mackay—for dyeing wool black. Various writers mention that in the Highlands of Scotland it is made use of to dye a dark brown or chestnut colour, and that goats and swine eat the roots as fodder. Theophrastus, referring to a white water-lily (which was plentiful in the pools and marshes of the Island of Crete, and is generally supposed to have been *Nymphaea alba*), said, 'The Boeotians call it Madonia, and eat the fruit. It bears large leaves upon the water; these ground and placed on wounds are said to stop blood. It is useful as a drink for intestinal disorders.'

Culpepper says of the white water-lily that 'the leaves and flowers are cold and moist but the roots and seeds are cold and dry, the leaves both inwards and outwards are good for agues, the syrup of the flowers produces rest and settles the brain of frantic persons. The distilled water of the flowers is effectual for taking away freckles, spot, sunburn and morpew from the face and other parts of the body. The oil of the flowers cools hot tumours, eases pains and helps sores.'

The leaves, being cooling and softening, have been used in the past as a dressing for blisters. Lindley, in *Flora Medica*, observes that 'the stems being extremely astringent are sometimes used in the composition of poultices, answering a purpose similar to that of lead poultices and alum curds'.

Water-lily blooms make good cut flowers, especially the tropical forms. The hardy sorts are frequently spoilt, towards evening, by the tendency of the cups to fill with water, when the flowers commence to close. Besides spoiling the appearance, this shortens their span of life; it is a good plan to remove the blooms from the bowl over night, laying them flat on the table until next morning.

The Gardener's Chronicle, some time back quoting from the *New York Garden Digest*, referred to the results of experiments made by the staff of the Missouri Botanical Garden to keep cut *Nymphaea* blooms from closing in the late afternoon. 'The experiments show that it is possible to keep the blooms open for several days and nights continuously by treatment with paraffin wax. With the aid of a medicine dropper, melted paraffin wax is applied in small quantities to the extreme lower portions of the stamens, petals and sepals. A wax with a melting point not higher than 47° C. must be used, or the flowers will suffer injury from the heat; rapid cooling of the wax after contact is also important. The wax is uniformly dispersed among the various organs, thus forming a cast that holds the flower head firmly in position. If the operation is carefully done the wax is scarcely visible; but if preferred, it may be tinted with dye, to match the colour of the flower.' I may say that I have managed to prolong the life of hardy water-lilies many times by this method. In the absence of paraffin wax candle grease is very effective.

As far as is known, there are thirty-nine species of water-lilies—a number which does not include the giant *Victoria*. The following is a list of species and varieties arranged alphabetically, the name in brackets denoting the raiser and year of introduction. The letters *A*, *B*, *C* or *D* serve to show the growing capabilities of the plant, and are designed to give a rough idea of the surface area covered and the depth of water required for successful cultivation. The inclusion of two letters means that the plant is equally adapted for either position. Cultural directions for the hardy water-lilies are given in Chapter III.

A. Extra strong growing forms for lakes and large pools.

Surface area covered—8 to 10 sq. ft.

Depth of water—2½ to 3 ft.

B. Strong growers for medium-sized pools.

Surface area covered—5 to 7 sq. ft.

Depth of water—18 to 24 in.

C. Medium growers for small pools and tubs.

Surface area covered—roughly 4 sq. ft.

Depth of water—12 to 18 in.

D. Weak or small growing forms for miniature pools.

Surface area covered—18 to 24 in.

Depth of water—4 to 10 in.

N. alba, our native *Nymphaea*, and the European white water-lily. This species actually seems to flower better in very deep water, and will even negotiate through 11 ft. The flowers are pure white, 3-4 in. across, and the foliage is green. *A.*

alba candidissima is a very robust, but not free-flowering form with pure white blooms. It is possibly a cross between *alba* and *candida*. *A.*

alba plenissima is a large flowered form of *Nym. alba*. *A.*

alba rubra (*sphaerocarpa rosea*) (*Casparyi*), the Swedish red water-lily, rarely seen in this country. A beautiful variety, it needs very cold water for successful development: on opening, the flowers are pale pink, changing with age to a deep red. The plant was introduced into England in 1878 by Froebel of Zurich, and originally sold at the amazing price of £5 a root. *A.*

Albatross (Marliac, 1910) bears exceptionally large snow-white flowers with golden-yellow anthers; the leaves are rich purple when unfolding, changing to deep green as they reach maturity. *C.*

Andreana (Andreyana) (Marliac, 1895). This is a very free-flowering variety of an unusual shade of dark red overlaid with yellow; the glossy green foliage is heavily blotched with red. *C.*

Amabilis (Marliac, 1921) is a beautiful variety; it has large stellate flowers of a soft salmon-pink shade, which deepens to rose with age. Orange-yellow stamens. *A* and *B.*

Arc-en-Ciel (Marliac, 1901) bears sweetly scented flowers of a salmon-white colour, with rose-splashed sepals; the foliage is blotched with bronze, white, rose and purple markings in a most fantastic manner. The plant is well worth growing for its foliage alone. *B.*

Arethusa bears flowers something like James Brydon, but of a much darker shade. This form was originally introduced by Dreer, who described it as an improved form of *fulgens*. *B.*

atropurpurea (Marliac, 1901) carries widely opened flowers of a brilliant shade of dark crimson. The young foliage is purple, passing to green with maturity. It is undoubtedly the darkest flowered hybrid we possess. *B.*

Attraction (Marliac, 1910) bears flowers of a glowing garnet-red, 7 to 8 in. across, and green foliage. *A.*

Aurora (Marliac, 1895). A remarkable form on account of the varying changes of colour throughout successive stages of growth. Opening a yellow shade, the flowers become orange the next day, finally turning dark red by the third. The plant is free-flowering and has prettily mottled foliage. *D.*

Baroness Orczy (Marliac, 1937) is a new variety with rose-pink flowers. *B.*

Bory de Saint Vincent (Marliac, 1937) is a new variety with red flowers. We have not seen this form and know nothing of its habit.

Brakleyi rosea. One of the finest pink forms of medium growth, this *Nymphaea* bears fragrant, deep rose-pink flowers standing just above water level; the foliage is green. *B.*

candida is a pretty little species widely distributed throughout North and Arctic Europe and Asia, south to Bohemia and the Himalayas. The flowers are small, pure white, uniformity of colour being relieved by a red stigma; the foliage is green. *D.*

candida biradiata, *candida neglecta* and *candida* var. *minor Wainio* are botanical forms, not worth cultivating and only interesting to the collector.

Nym. Wenzelii, mentioned in several floras of the U.S.S.R., appears to be a more stellate form of *Nym. candida*. *D.*

Carisbrookii bears fragrant flowers of a delicate rose-pink shade. *C.*
caroliniana. This variety is probably a natural hybrid from *odorata rosea* and *tuberosa*, for it appears to be a stronger and improved edition of the former. The flowers are of a delicate rose-pink colour, with yellow stamens and sweetly scented. Under favourable conditions the foliage becomes very large, occasionally twelve or more inches in diameter. *B* and *C.*

caroliniana nivea (Marliac, 1893) is a very large flowered form of the white *Nymphaea odorata*, well adapted for small pools by reason of its fragrance and profusion of bloom. *C.*

caroliniana perfecta (Marliac, 1893) is also very fragrant and has salmon-pink flowers. *B*.

caroliniana rosea (Marliac, 1908), an improved form of preceding, with deeper-coloured blooms. *B* and *C*.

Charles de Meurville (Marliac) gives wine-coloured blooms often 10 in. across. It is a very vigorous variety, and needs plenty of room.

chrysantha (Marliac, 1905) bears small flowers of a pale reddish-yellow shade, which pass with age to cinnabar-red. It is free-flowering, but of no great horticultural value. *D*.

Colonel Welch (Marliac), with canary-yellow flowers standing 5-6 in. out of the water, is inclined to make too much foliage in proportion to the flowers produced. In our opinion, this variety is hardly worth growing—there are so many better forms available. *A*.

Colossea (Marliac, 1901) is a very large variety, with flesh-coloured petals; it is free-flowering, and in character from early spring until the frosts. *A*.

The flowers of *Comanche* (Marliac, 1908) open a rich rose overlaid apricot, passing to a deep coppery-red as they mature. This shade in conjunction with the orange stamens affords a distinct coloration feature among the hardy water-lilies. The young foliage is purple passing to green with age. *C*.

Comte de Bouchard (Lagrange, 1904) bears purplish-rose flowers with apricot stamens. The blooms are small, but very free. *B*.

Conqueror (Marliac, 1910), a most attractive variety which blooms prolifically. The inside of the sepals are white, and contrast well with the flowers which are of a brilliant red shade flecked with white. *B* and *C*.

Darwin (Marliac, 1909) bears variegated flowers of a red shade, heavily striped with white. It is sweetly scented; the foliage is green. *B*.

Dawn is dazzling white with pink-tinged sepals. The flower is large with the delightful fragrance of the *odoratas*. *B*.

delicata (Henkel, 1899) is a hybrid from *candida* with white tulip-shaped flowers. *D*.

Eburnea (Marliac), bears white flowers overlaid with green and pink lines; they are well shaped and sweetly scented. The foliage is bright green. *C*.

Ellisiana (Marliac, 1896). Has small garnet-red flowers with orange-red stamens and green leaves. This variety is inclined to fasciation.

erecta bears thin white flowers standing well above water level. *C*.

Escarboucle (Marliac, 1909). This is a water-lily without equal for richness of colour, bearing large wine-crimson blooms which under favourable conditions will attain the size of soup-plates. The plant is free-flowering and very prolific. *A* and *B*.

Esmeralda (Marliac, 1912) bears stellate flowers of a red hue, variegated with white. *C*.

Eucharist (Marliac, 1912) carries large open flowers of a soft rose shade, heavily flecked and splashed with white. *C*.

Eugenia de Land. Gives medium sized, stellate flowers standing several inches above water level; they are of a rich pink shade with golden-yellow stamens. *C*.

Evangeline (Shaw) is a free-blooming variety with star-shaped blossoms of an exquisite pearly flesh-colour. *C*.

Fabiola (Marliac, 1913). A meritorious variety with a long flowering season. The blooms are large and open, of a rich pink shade with mahogany stamens. The foliage is green. *B*.

fennica is the Finnish water-lily and very rarely seen in cultivation, probably because it requires extremely cold water such as a pool fed with spring water. The flowers are pure white, small and cup-shaped; the bright green foliage also being well below average size. *B* and *C*.

Fire Crest is an American variety with fragrant, deep pink flowers. The petals lie widely open, so that the red-tipped stamens stand erect in the centre. This gives them an unique appearance and probably suggested the colloquial name. *C*.

Formosa (Marliac, 1909) bears soft rose flowers which pass to a deeper shade with age; rich golden stamens and green foliage. *B*.

Froebeli (alba Froebeli) (Froebel) is a first-rate variety for a small pool or tub garden. It is very free-flowering, easy to grow and of a delightful blood-red shade. *C*.

fulva (Marliac, 1894) gives thin blooms of a bright copper-red shade, but it is a poor doer and not worth growing. *C*.

Galatée (Marliac, 1909) has soft rose flowers, flecked and spotted with white. The foliage is green heavily variegated with purple. *B*.

Gladstoniana (Richardson, Ohio) is in our opinion one of the finest water-lilies for a large pool. The cup-shaped flowers are of purest white with golden stamens, and very large. The foliage is dark green, and stands right out of the water when well established. *A*.

Gloire de Temple-sur-Lot (Marliac, 1913). This variety is distinct by reason of the very double flowers; it is not unusual to find as many as 100 petals on a single flower. They are soft creamy-white, slightly incurved, so that the bloom has somewhat the appearance of a Japanese chrysanthemum. *A* and *B*.

Gloriosa (Marliac, 1896). A very fine red form which is extremely popular in the U.S.A. The flowers are exquisitely scented, generally 6 to 7 in. across, and full open from ten o'clock in the morning until four o'clock in the afternoon. *B*.

Goliath (Marliac, 1912) bears tulip-shaped flowers with very long petals: of a white shade tinged with pink. The addition of conspicuous white stamens and orange-red petaloids creates a distinctive coloration feature and renders the variety one of our most beautiful. *A*.

Gonnère (Crystal White) (Marliac, 1914) bears large, double snow-white flowers and green foliage. The olive-green sepals clasp the corolla and so give the flower a cup-shaped appearance. The plant is in bloom off and on practically all the summer. *A* and *B*.

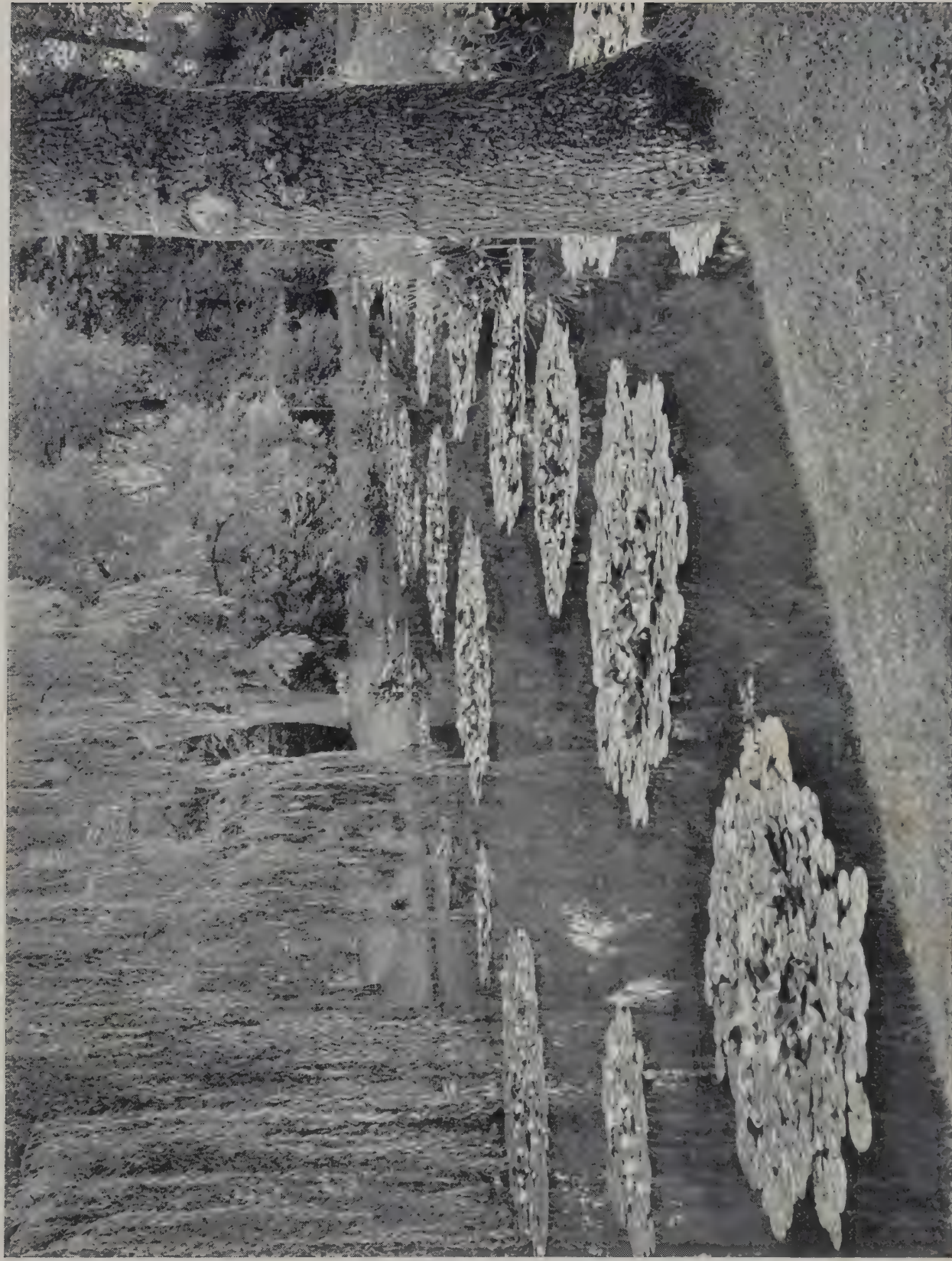
gracillima alba (Marliac, 1901) bears flowers of a pure white shade, 6 to 7 in. across; the petals narrow and tapering. It appears to be lost to cultivation. *B*.

Graziella (Marliac, 1904) bears pretty reddish-yellow flowers, which are inclined to become lighter with age; the foliage is heavily variegated with purple. This variety is free-flowering and an excellent form for tub culture. *C*.

Hassell is a pretty hybrid between *Marliacea* and *Mexicana* which blooms most freely in deep water. It is of vigorous constitution, with rich yellow flowers 5 to 7 in. across: the petals are extremely long and pointed. *D*.

Hermine (Marliac, 1910) gives medium-sized, star-shaped flowers standing well erect from the water; they are pure white with green sepals. Foliage bright green. *C*.

Hermosa (Henkel, 1904) bears fragrant rose-pink flowers. Lagrange cites this plant as being synonymous with *Brakleyi*, but we cannot say for sure, not having seen *Hermosa* in flower. *B*.

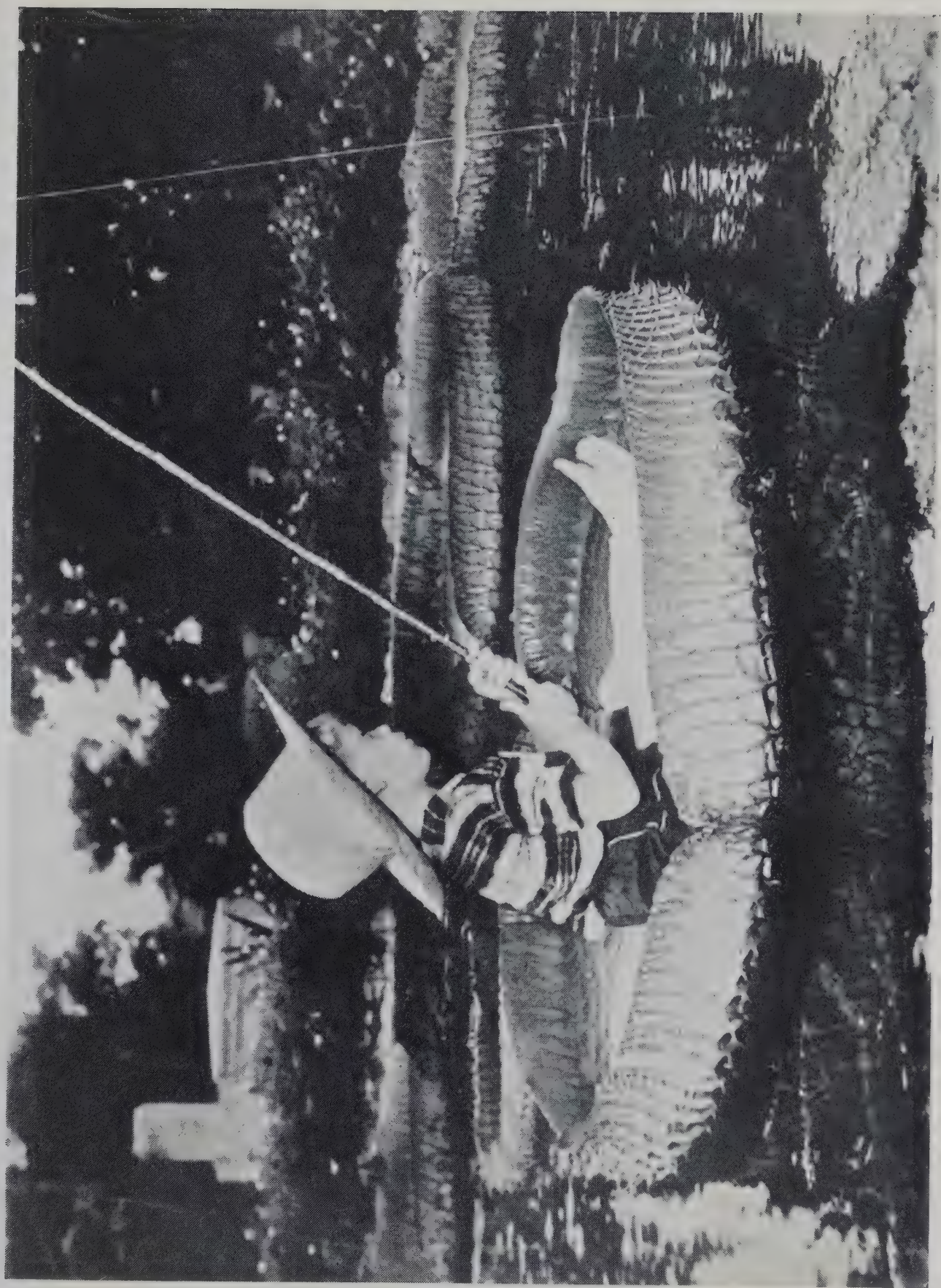


PERFECTION OF PLANTING

Weeping Willows shade the still waters



NYMPHAEA STELLATA AND EICHHORNEA SPECIOSA GROWN
IN A HEATED OUTDOOR POOL



THE SMALL FISHERMAN FINDS THE PADS OF VICTORIA REGIA MAKE AN EXCELLENT BOAT



SPRING HARBINGERS
Marsh Marigolds by the water-side



SPRING BY THE STREAM

Hever White (Astor, 1937) is an exceptionally strong grower though inclined to be a shy bloomer. The flowers are stellate, very large and of a milk-white colour. *A.*

Indiana (Marliac, 1912) is a beautiful form which shows a great deal of variation in the flowers. These open a delicate orange-red, gradually darkening with age until the mature flower is a brilliant shade of rich copper-red. The foliage is heavily spotted and mottled with purple. *B.*

J. C. N. Forestier (Marliac) bears flowers standing well above water level. On first opening these are of a soft copper-rose shade, with orange-red stamens, but the colour is intensified as the blooms mature. *B.*

James Brydon (Dreer). A very fine American variety bearing cup-shaped flowers of a rich carmine-red. This we consider one of the finest of the hardy water-lilies, well adapted for natural or artificial pools: it will succeed in partially shady positions. *B.*

James Hudson (Marliac, 1912) carries large stellate flowers of a purplish-crimson shade; green foliage. *B.*

Jean de Lamarsalle (Marliac) has deep pink flowers. *C.*

lactea (Marliac, 1907) bears medium-sized flowers of a pinkish hue which pass to a milky-white with age. *B.*

With the *Laydekeri* section, we come to a group of hybrid lilies of medium growth eminently suited to tub culture. They were all raised by M. Marliac who probably used *Nymphaea tetragona* as one of the parents, for, although differing in size and colour there is a distinct resemblance in the shape of the flowers. Their free-flowering propensities ensure them great popularity: it is not uncommon to find as many as fifty to sixty blooms out at once on a well-established plant of *L. purpurata*. As a general rule the foliage is not large, and a uniform shade of green.

Laydekeri fulgens has flowers of a brilliant crimson-magenta hue with fiery-red stamens. *C* and *D.*

Laydekeri lilacea throws fragrant blossoms of a soft rose-lilac shade, which deepen with age to bright carmine. The stamens are yellow. *C* and *D.*

Laydekeri purpurata is the freest-flowering form of the group, and in bloom throughout the whole season. It is of a rosy-crimson shade, slightly spotted and flecked with white. *C.*

Laydekeri rosea is perhaps the loveliest of all the *Laydekeris*, but,

unfortunately, almost if not quite lost to cultivation. The fragrant deep rose blossoms, of a perfect cup-shape, float flat upon the water, and are in character throughout the whole of the summer. *C.*

Leviathan (Marliac, 1910) bears large fragrant flowers of a soft pink shade, and green foliage. *A.*

The blooms of *Livingstone* (Marliac, 1909) have very long petals which give a certain resemblance to the flowers of a tulip; they are delicately scented, of a bright red shade flecked with white. The stamens are mahogany-red. *C.*

Loose is an American variety reminiscent of the tropics. The flowers are pure white, stellate and borne 8 to 10 in. above water level; they are 5 to 7 in. in diameter and sweetly scented. *B* and *C.*

Lucida (Marliac, 1894) has flowers of a rosy-vermilion with a darker centre. The plant is free in growth and flower, and has purple variegated foliage. *B.*

Lusitania (Marliac, 1912) is deep rose with brilliant mahogany stamens: the young foliage is purple but changes to green with maturity. *A.*

Lustrous. An American hybrid with free-flowering propensities; the blooms are of a satiny rose-pink shade and seed readily. *B* and *C.*

Marguerite Laplace (Marliac, 1913). A meritorious variety with widely-opened flowers of a delightful rose shade, deepening in colour towards the edges of the petals. It is in bloom throughout the whole of the summer and bears purplish-green foliage. *A* and *B.*

Mme. Bory Latour Marliac (Marliac, 1937) is a new variety with pale pink flowers. *C.*

Mme. de Bonseigneur (Marliac, 1937) has streaky pink flowers. *C.*

Mme. Julien Chiffot (Marliac, 1921) produces very large flowers, sometimes nearly a foot across, of a rich pink shade. *B.*

Mme. Maurice Laydeker (Marliac) bears globular flowers of a uniform shade of cherry-red. *B.*

Mme. P. Cazeneuve (Lagrange?) is a very fine variety with large cup-shaped flowers raised above water level. They are of a purplish-rose shade, sweet scented and very free. *C.*

Mme. Wilfron Gonnère (Marliac) bears large, double rose-pink flowers and green foliage. *B.*

Mark Hanna (Marliac) is a form which appears to be lost to cultivation. The flowers are pink. *B.*

Marliacea albida (Marliac, 1880). Any water-lily with the prefix *Marliacea* carries its own guarantee, for every variety is of outstanding merit. *Marliacea albida* has snow-white flowers standing just above the water; they are freely produced and very fragrant. The foliage is green. *A* and *B*.

Marliacea carnea (Morning Glory) (Marliac, 1887). Similar to the preceding but with a rosy tinge at the base of the sepals and outer petals. This coloration is often not apparent until the plant has been established for a year or two. *A* and *B*.

Marliacea chromatella (Marliac, 1877) is a very charming shade of canary-yellow with bright yellow stamens. The olive-green foliage is beautifully mottled with bronze markings. *B*.

Marliacea flammea (Marliac, 1894) has olive-green foliage prettily mottled with chestnut-brown: and amaranth flowers, shaded and flecked with white. *C*.

Marliacea ignea (Marliac, 1893) produces flowers 4 to 5 in. across, of a vivid carmine shade with glaring red anthers. The plant is extremely free, and bears rich bronze leaves which turn with age to dark green mottled with brown blotches. *C*.

The blooms of *Marliacea rosea* (Marliac, 1887) make good cut flowers, as they are large, fragrant and lasting. They are of a deep rose shade which is intensified towards the centre, but the full depth of the colour is not attained until the plant becomes well established. *A* and *B*.

Marliacea rubra punctata (James Gurney) (Marliac, 1889) bears medium-sized flowers of a globular shape and a deep rosy-carmine shade. *B*.

Mary Exquisita is a sweet-scented variety with flowers 5 to 6 in. across, of a beautiful soft pink shade. It is a free and continuous bloomer. *B*.

Mary Patricia (Johnson), an American variety, very free in character with peach blossom-pink flowers. *C*.

Masaniello (Marliac, 1908) is a fine sweet-scented sort of large size and beautiful deep rose colour: very free in growth and flower. *B*.

Maurice Laydeker (Marliac) is of poor constitution and rarely seen in cultivation. The flowers are a deep rose-red flecked with white. *C*.

Meteor (Marliac, 1909) bears red flowers streaked with white. *B*.
mexicana (flava) is a species from Florida and Mexico which is

not quite so hardy as the majority of the Castalian group. The foliage is green, heavily blotched with purple, and with a reddish under-surface; the flowers are bright yellow and stand several inches above water level. *B.*

Moorei (Mooreana), a fine lily of delicate canary-yellow colouring with bright yellow stamens. Green foliage, heavily spotted with brown, forms an admirable foil to the flowers. This variety is very similar to *Marliacea chromatella*; it was raised in the Botanic Gardens of Adelaide about 1900. *B.*

Mrs. C. W. Thomas (Johnson) is a new American hybrid with very fine semi-double shell-pink flowers. The plant is very free, fragrant and easily grown. *B.*

Mrs. Richmond (Marliac, 1910) bears immense, globular deep pink flowers. The plant is scentless but very prolific; the foliage is green.

Murillo (Marliac, 1910) has star-shaped flowers with pointed petals, floating flat upon the water. These are of a bright rose shade, the outer ring of petals being flushed with white. *B.*

Neptune (Marliac, 1914) bears deep rose-crimson, stellate flowers with rosy stamens. The young foliage is purple, changing with age to olive-green. *B.*

Newton (Marliac, 1910) is reminiscent of the tropical forms, with star-shaped flowers standing out of the water. They are of a brilliant rose-vermilion shade with long orange stamens. *B.*

nitida, a rare species from Siberia, is thought by many authorities to be synonymous with *Nymphaea odorata*. The rootstock, however, is perpendicular instead of horizontal—a fact which we consider, together with other minor differences, renders it a distinct plant. The flowers are cup-shaped, white with blunt petals, scentless and slightly smaller than *odorata*. *C.*

Nobilissima (Marliac, 1912) is very like *Newton*, but with blunter petals and rose flowers. *B.*

Odalisque (Marliac, 1908), a *tuberosa* form with the flowers standing 4-5 in. above water level. They are of a delightful rose shade, changing to shell-pink with age: the stamens are golden. *B* and *C.*

odorata, the fragrant water-lily of North America, is the parent of a good many garden hybrids. They are all fragrant, but produce less blooms per season than the Marliacs, and should be given a fair amount of room, as, once established, they become

very prolific. The type, *Nymphaea odorata*, gives pure white flowers and pale green foliage. *B* and *C*.

odorata exquisita (Marliac, 1878) produces flowers of an intense rose-carmine tint. *C* and *D*.

odorata gigantea (Hopatcong) (*acuta*), a native of the South-Eastern United States requiring very deep water and plenty of space. It has large pure white flowers and bold green foliage. *A*.

odorata Helen Fowler is perhaps the finest of the whole section. The blooms may reach 9 in. across and are of a perfect, deep rose shade. It is powerfully almond scented. *B* and *C*.

odorata Jessieana. Mentioned by Bisset, who described it as of large size and fine form, and a beautiful, even pink colour. *B* and *C*.

odorata Luciana (Dreer) bears stellate flowers of a rich glowing rose colour. It is sweetly scented, with green foliage. *C* and *D*.

odorata minor. A small form, only half or quarter the size of the type, found growing in North America. The dainty pure white flowers are extremely fragrant, whilst the soft green leaves bear a reddish under-surface. *D*.

odorata minor floribus roseis is a variety of the preceding, with pink reverses to the petals and sepals. It is native to the U.S.A. *B*.

odorata rosea (*odorata rubra*) is the Cape Cod pond water-lily, practically unknown to cultivation in Europe. It bears intense rose-pink flowers, which deepen in colour towards the centre, and yellow stamens. The foliage is purplish-green. It is found locally in North America. Millspough gives the following interesting note concerning the plant: 'On a plat of low bottom land near Buffalo, Putnam County, the plough turns up a large number of small tubers each season that the soil is cultivated. These, planted in tubs, produce, much to the astonishment of the neighbourhood, beautiful deep pink water-lilies. How long this bottom has been drained is not known, but the evidence adduced, by the fact above stated of the existence of a pond here, certainly over a century ago, is very interesting.' *B* and *C*.

odorata rosea prolifera (Perry, 1900) is a very free variety with fragrant, delicate pink flowers, which deepen to rich rose and later to carmine. *B*.

odorata sulphurea (Marliac, 1879). This pretty variety, with deep sulphur-yellow flowers standing above water level, is a hybrid between *odorata* and *Mexicana*. The leaves are blotched with chocolate-coloured markings. *C*.

odorata sulphurea grandiflora is a variety sent out by Marliac in 1888 with larger flowers and leaves than the preceding. *C*.

odorata Turicensis is a free-flowering form with soft rose blossoms, sweetly scented. *B* and *C*.

odorata Wm. B. Shaw (Dreer) is a very desirable water-lily with good-sized, cup-shaped flowers of a delicate pink shade. The inner zone of the corolla is marked with deeper coloration and affords a delightful contrast to the rest of the petal. *B* and *C*.

In *Paul Hariot* (Marliac, 1905) we have a charming little water-lily which shows a great deal of variation between the young and old flowers. On opening, the colour is a delicate apricot-yellow, the next day it is orange-pink and this deepens almost to red on the ensuing days. The foliage is green, attractively spotted with maroon; the plant is of small habit but very free-flowering. *C* and *D*.

Phoebus (Marliac, 1909) bears yellow flowers heavily overlaid with red, and fiery orange stamens. The foliage is most attractive with brown and purple blotches. *C*.

Phoenix (Marliac, 1913) bears bright red blooms lined and striped with white: foliage green. *C*.

Picciola (Marliac, 1913) is an exceptionally strong-growing variety with abundant flowers, frequently 9 to 10 in. across, of a vivid shade of amaranth-crimson. *A*.

Pink Opal throws stellate flowers of a coral-pink shade several inches above water level. They make good cut blooms. *C*.

President Viger (Marliac, 1906) bears vivid rose flowers; it appears to be lost to cultivation. *B*.

Princess Elizabeth (Perry, 1935). This pretty hybrid is a seedling of *Brakleyi rosea*. It is a charming peach-blossom hue which deepens in intensity with maturity; the plant is free-flowering. *C*.

punctata has rosy-lilac flowers flecked with carmine. *D*.

pygmæa alba. Although often quoted as synonymous, this plant is quite distinct from *Nymphaea tetragona*. We have been growing the two forms for some years, and undoubtedly *pygmæa alba* bears larger flowers and is of stronger habit than *tetragona*. It is probably a form of *candida*, and has proved a useful plant for miniature pools. *D*.

pygmæa helvola (Marliac, 1879) is the smallest and prettiest pygmy form. The tiny, star-shaped flowers are of a delightful

soft sulphur shade and produced in abundance throughout the season. The olive-green foliage is prettily streaked and marked with brown and maroon blotches. It is a dainty little plant, worthy of cultivation in every water garden. *D.*

pygmæa Hyperion (Perry, 1937), a new red pygmy, somewhat larger than *alba* or *helvola*, with amaranth blooms. Very free. *D.*

pygmæa rubra. The blooms and leaves of this variety are a good deal bigger than the rest of the pygmy forms, although the plant does not seem to become larger from one year's end to another. The flowers open a delightful shade of rose, the outer petals being lightly flushed with pink, and eventually change to a rich garnet-red. The foliage is green with a reddish under-surface. *C* and *D.*

pygmæa rubis was raised by Marliac in 1925, who described it as the smallest red variety and very floriferous. The flowers are carmine streaked with white. We have never seen this form, so have had no opportunity of comparing it with *pygmæa rubra*. From descriptions alone, however, it is obvious that the two plants are quite distinct. *D.*

Radiance (Shaw, 1930), a pretty variety of American origin with iridescent shell-pink flowers, which deepen in colour towards the centre. *B.*

Rene Gerard (Marliac, 1914) bears stellate flowers frequently 9 in. across, of a rich rose hue, flecked and striped with crimson. This variety is very free-flowering. *B.*

Robinsoniana (Robinsoni) (Marliac, 1895) produces fine flowers of unique colouring. They are yellow, heavily overlaid with rose-vermilion: open from nine in the morning until six at night. The foliage is spotted with maroon. *C.*

Rose Arey. A very fine form with large stellate flowers in which the petals are slightly incurved. This is of a uniform shade of rich rose-pink, very free and delightfully fragrant, *B* and *C.*

Rose Magnolia bears delightful pink flowers, 4-5 in. across, standing well out of the water. *B.*

In *Rose Nymphe* (Rosennymphe) (Junge) we have one of the most beautiful of all the hardy water-lilies. The large, open flowers, 6-7 in. across, are of an exquisite shade of deep rose; they are fragrant and produced in abundance from early spring until late autumn. *B.*

Rosita (Marliac, 1908). A poor variety with small, purplish-pink, star-shaped flowers. *B.*

Roswitha (Buggele). A rose-coloured *odorata* form, sometimes listed in German catalogues. We have never seen this variety and can give no further information concerning it. *B*.

Rosy Morn (Johnson, 1932), an American form with large stellate flowers of an exquisite shell-pink shade. *B*.

Sanguinea (Marliac, 1894) is a brilliant shade of crimson-carmine with orange-red stamens. The leaves are olive-green beautifully blotched with brown. *C* and *D*.

Seignoureti (Marliac, 1893) is a charming little form carrying orange-red flowers with buff-coloured bases. They are borne well above water level; the foliage is prettily marked with chestnut-brown spots. *D*.

Sioux (Marliac, 1908) is another variety which changes colour. Opening a soft yellow suffused with red, it is eventually transformed to an attractive shade of reddish-copper. *C*.

Sirius (Marliac, 1913) bears dirty-looking flowers of a fawn shade, lined and spotted with red. The foliage is attractive, being heavily spotted with brown and purple. *B*.

Solfatare (Marliac, 1906) bears stellate flowers of a yellow tint flushed with rose; the foliage is heavily mottled with maroon. *C*.

Somptuosa (Marliac, 1909) throws globular flowers of a rose-pink shade; it is very fragrant and has orange stamens. *C*.

Souvenir de Jules Jacquier (Marliac, 1921) is of vigorous constitution, and bears globular flowers of a uniform shade of mauve-pink. *A*.

speciosa (Marliac) is flesh pink. *B*.

Splendide (Marliac, 1909) bears dark ruby flowers of a good size. *B*.

Suavissima (Marliac, 1899) carries flowers of a delightful shade of rose-pink; they stand above the water and are very fragrant. *C*.

Sultan (Marliac, 1910) produces large red flowers streaked with white, and green foliage. *C*.

Sunrise. This American variety is undoubtedly the finest yellow yet introduced—of a glorious sunny shade with golden filaments. The individual blooms are very large and fragrant; the foliage—green with a red under-surface, flecked with brown. *B* and *C*.

Sylphida is a free-flowering form, with deep red blooms heavily streaked and flecked with white on the outer petals. *B*.

tetragona is the baby of the hardy water-lilies. The species is

widely distributed, being found under various forms in India, Australia, America, China, Siberia and Japan. It was first introduced into this country as long ago as 1805, and has proved quite hardy where there are 8 or 9 in. of water covering the crown. The small white flowers are very dainty, about the size of a crown piece, and seed freely. The seed sown in March will produce flowering youngsters the same season. The olive-green foliage is, according to Rein, gathered in the bud state, pickled with vinegar and eaten by the Japanese. *D.*

tetragona angusta. There are two forms, *t. ang. indica* from India with blotched leaves and *t. ang. orientalis* from China and Japan with leaves of a uniform shade of greenness.

tetragona Georgi (acutiloba) is a Chinese form of the type.

tetragona grandiflora is a larger flowered form of the type introduced by Lagrange in 1900. *D.*

tetragona himalayense is an Indian form introduced by Sprenger in 1902. *D.*

tetragona lata is found in Eastern and Northern Asia. *D.*

tetragona leibergeri is the North American form. As far as we are aware, none of these varieties of *tetragona* are in cultivation. *D.*

Tove (Larsen, 1915), a desirable sweet-scented variety of medium growth and excellent for tub culture. The flowers are white faintly lined with rose, the petals being thin and pointed so that the whole bloom somewhat resembles a cactus dahlia. *D.*

tuberosa (reniformis) is found plentifully distributed throughout the Great Lakes of North America, the foliage forming an article of diet for deer. It bears pure white, cup-shaped flowers, very sweetly scented. *A.*

tuberosa Pæstlingberg (Buggele of Linz). An introduction from Austria with much larger flowers than the type. *A.*

tuberosa Richardsoni (Richardson) is a vigorous free-flowering form well adapted for the large pool: the flowers are globular in shape, pure white with conspicuous green sepals. *A.*

tuberosa rosea is a strong-growing form which needs to be kept under control. The foliage is light green and the flowers medium-sized, of a soft pink colour and very fragrant. *A* and *B.*

tuberosa rubra was introduced by Sturtevant in 1901. The flowers, 5 to 7 in. across, are of a beautiful rosy-red colour with ruby stamens. The plant possesses the delicate perfume of the *odoratas* and grows freely, but is inclined to be a shy blossomer. *B.*

Tulipiformis (Marliac) bears gigantic, tulip-shaped, deep rose flowers with widely-extended sepals. *B.*

Venusta (Marliac, 1910) has open flowers of a uniform shade of rich pink. *C.*

Vera Louise, reputed to be a cross between *Gladstoniana* and *Marliacea rosea*; this variety bears very large, soft pink flowers. It is very free. *A.*

Vesuve (Marliac, 1906) bears well-shaped flowers, 6-7 in. across, of a fiery amaranth-red. *C.*

In *Virginalis* (Marliac, 1910) we have an exquisite white water-lily of perfect contour and unblemished colour. The purity of the flowers is accentuated by the greenness of the foliage; it is in bloom throughout the whole of the summer. *A* and *B.*

Vomerense (Sprenger, 1904). A miniature form, as far as we know, lost to cultivation. The flowers are small and white. *D.*

Wm. Doogue. Introduced by Dreer in 1899, this variety bears very large flowers of a delicate shell-pink shade which fade to white with age; it is free in growth and flower. *B.*

Wm. Falconer (Dreer). With the exception of *atropurpurea*, this variety is the darkest in colour of all the hardy water-lilies in cultivation. The flowers, measuring 6-7 in. in diameter, are of a bright ruby shade with yellow stamens. The dark red foliage passes with maturity to green with prominent red veins. *B.*

CHAPTER VI

The Tender Water-Lilies

THE EXOTIC beauties of tropical flora have surely reached perfection in the tender water-lilies, for they seem blessed with every desirable attribute that a plant can possibly possess. Rivalling the rainbow in their wonderful range of colour, the flowers stand erect out of the water, and follow each other in unbroken succession throughout the whole summer, and under certain conditions—during the winter as well. Again, many are nocturnal flowering and almost all delightfully scented, with the rich, fragrant aroma of ripe fruit. They are excellent as cut flowers, the long, firm stems permitting easy handling and lending themselves to artistic arrangement in erect vases. Some of the day-flowering hybrids will stand a fortnight after gathering, suffusing the air with a warm fragrance, reminiscent or suggestive of oriental mysticism.

It is unfortunate that the plants are not more generally known, for they are not nearly so difficult to grow as is commonly imagined—sun and warmth, a good loamy soil and water being all that are needed for their successful cultivation. The tubers of tender water-lilies should be started in a warm house about February or March. They should be planted singly (in an upright position) in small flower pots filled with loam, and immersed under 5 in. of water in a large pan or tub. Growth will be evident in a fortnight if a temperature of more than 70 degrees is maintained, and directly the true floating leaves appear the plants may be put out into the receptacle in which they are to grow. Tender water-lilies are gross feeders, they need abundance of food and plenty of room to expand. The more space they have, the larger the flowers and foliage produced: each plant should be supplied with at least a bushel of soil and a container one foot deep and two feet square. A sawn-down wine-cask will comfortably accommodate one plant. A sprinkling of decayed cow-manure or $\frac{1}{8}$ in. of coarse bonemeal should be placed over the bottom, followed by 10 to 12 in. of good turfy loam. Knock the water-lily out of the pot and plant it in the centre of the tub, barely

covering the crown with water. Increase this at intervals until the receptacle is full, and try to maintain this level, as it is not desirable to add too great a bulk of water *at any one time* afterwards. Tropicals are ill at ease in a temperature below 65° , so every effort should be made to keep the water as warm as possible.

In a heated greenhouse, the lilies may either be planted into a soil base in the pool, or put into large boxes (about 2 ft. square and 1 ft. deep) and stood on the floor. The latter plan is to be preferred on account of the gross nutritive demands of the plants, for it is much easier to lift and change the soil in these than to empty the entire pool. With an adequate heating system and a maintenance of temperature the plants will continue flowering throughout the winter, although it is as well to encourage flower growth by removing the embryo pods. This, however, is rather costly, so, if it is not desired to maintain the heating, the tubers can be treated as are dahlias, and lifted and stored away dry for the winter months. By shutting down the heat in early autumn the water cools and the foliage commences to die off. When this occurs, the tubers should be lifted and laid out to dry in a warm airy place, until all the old roots and foliage have rotted away. A number of small tubers may have formed at the base of the parent; if so, these should be broken off as propagating stocks for next year. Store the tubers in moist sand, in a temperature approximately about 55° , and take some precaution against mice and rats; rodents are particularly partial to them during the winter months when food is scarce.

A few of the tropical water-lilies lend themselves to cultivation in the outdoor pool—*Nymphaea stellata* is grown outside regularly at Wisley. Sometimes the tanks are heated by pipes which run into the pool from a nearby greenhouse, but occasionally, in very sheltered positions, they are planted out without even this advantage. In any case, it is as well to have only a few inches of water above the crowns so that the heat from the sun may adequately warm the soil at the bottom. Tender water-lilies planted outside in this manner do not as a rule receive sufficient warmth and sunshine properly to ripen the tubers, so they are best treated as annuals and renewed each year.

The nocturnal flowering hybrids are the strongest growers and may cover a space of from 12 to 15 ft. in diameter. If the foliage becomes too dense, some of the leaves may be removed,

taking them off close down to the roots. The viviparous forms, which bear tiny plantlets on the older leaves, appear stronger than most and will resist cold and survive at lower temperatures. Their peculiar method of propagation is described on page 31.

The method of hybridisation is somewhat similar to that of the hardy forms, but greater care must be exercised on account of the extreme readiness of the plant to fructuate. Two days prior to pollination, the parent buds are selected, forced open, and the stamens carefully removed with a pair of forceps. A rubber band is then slipped over the bud (at the tip) to prevent further opening and the unauthorised entry of insects. In two days' time, the pollen parent is selected and half a dozen stamens removed and slipped into a small glass tube. This is at once corked to prevent the entrance of insects, and is carried to the selected buds. The rubber bands are removed, and if the flower is in a receptive state (indicated by the presence of a spot of nectar in the centre), one or two stamens are laid on the stigma and the flower closed again with rubber bands. A small square of butter muslin is then tied completely round the inflorescence, secured by a length of thread to a stake, and left to ripen. Directly the capsule bursts, the contents of the muslin bag are placed in a jar of water, where they remain until the fleshy dehiscence rots away and the ripe seeds drop to the bottom. The water may then be drained off, the seeds dried, or sown straight away in a temperature of 75° to 80° F.

On looking through the list of day- and night-flowering varieties, we find that with the exception of Lagrange and Henkel it has been left to American hybridists to introduce most of our wonderful new forms. The Americans have long been lovers of the tender water-lily, and to Mr. George Pring especially we owe a great debt of gratitude. The Missouri Botanic Gardens at Tower Park (former country residence of the great horticulturist Henry Shaw) also look on the *Nymphaea* with a kindly eye, and have been instrumental not only in raising new forms, but in supplying us with a good deal of information about them. In one of their recent publications, there appeared coloured pictures of a number of fresh forms, derived from using the newly discovered *N. Burtii* as pollen parent. These varieties, at present unnamed, will undoubtedly take their place in the garden pools of to-morrow.

There are so many species and varieties of tender water-lilies, that we have found it beyond the scope of this book to give de-

tailed descriptions of each. We have accordingly described more fully the species, and the finest of the day- and night-flowering hybrids, giving brief notes concerning the others.

TROPICAL SPECIES

amazonum is a nocturnal bloomer with large yellowish-white flowers floating on the water. It emits a sweetish odour suggestive of peaches and is found in still water in Tropical America, Jamaica, Brazil and Mexico. The leaves are bright green, smooth and of a graceful oval shape.

amazonum goudotiana, with the same distribution, only differs botanically by the presence of a ring of long hairs at the top of the peduncle.

ampla is a native of Tropical and sub-Tropical America, bearing white, stellate flowers with bright golden stamens. They stand erect out of the water and open during the day. *ampla speciosa* bears smaller flowers and *ampla pulchellus* has still tinier blooms.

blanda is a small flowering species of no horticultural importance. The flowers are thin and yellowish-white. The plants are found in swamps in Tropical America and Jamaica. *blanda fenzliana* is slightly larger than the type.

Burttii. For years *Stuhlmannii* and *sulfurea* have been considered the only yellow-flowered tender species, until, in 1929, Burtt discovered in Tanganyika this delightful new plant. The flowers are deep primrose, 8 in. in diameter, and float upon the surface of the water. Burtt records that on examining the flowers in their native habitat they contained a great number of dead bees. Pring states in *Ann. Miss. Bot. Gard.*, 1933, that it is a difficult plant to grow and a poor propagator, but mentions that hybrids do well in cooler water and are readily propagated from tubers.

Results of growing this species and *Stuhlmannii* together, both at Kew and in America, seem to indicate that these two species may be identical.

cærulea. This very ancient and beautiful plant is by some authorities cited as the Blue Lotus of the Nile. See Chapter VII. It is plentifully distributed throughout northern and central Africa and bears sky-blue flowers 6 to 7 in. across, with black spotted sepals. These stand well out of the water, are delightfully scented and open from 7.30 a.m. until 12 midnight. *cærulea* var. *albiflora*

(voalefoka) is a very rare Egyptian form with white flowers. Syn. *N. nubica*.

calliantha bears pink, violet or light blue, star-shaped flowers with deep yellow sepals. Tropical Africa.

calliantha tenuis has white or pale blue flowers.

capensis (the Cape Blue Water-lily) is found throughout southern and eastern Africa and in Madagascar. It is very lovely, with sweet-scented flowers of a rich sky-blue colour. The leaves are green blotched with purple. *capensis madagascariensis* is a small-growing variety of the preceding. Syn. *N. emirnensis*.

capensis var. *zanzibariensis* (the Royal Purple Water-lily). This is one of the finest of all the tropical water-lilies and extremely free in flower and growth. The blooms are of a rich dark blue shade, very fragrant, with golden stamens tipped with navy blue. *azurea* and *rosea*, two garden hybrids, are delicate azure-blue and deep rose respectively; they are of outstanding merit and well worth cultivating in the indoor pool.

citrina, a yellow-flowered form gathered by Peter in East Africa. Mr. Pring of the Missouri Botanic Garden, who has grown this species, says 'It is rather early to say that *N. citrina* is a good species, it may be a variety of *Stuhlmannii*. It certainly possesses a characteristic peculiar to that species in that it is a poor propagator—out of 86 seeds sown only one plant germinated'.

dentata, from Sierra Leone, has very large pure-white flowers, with narrow petals, 8 to 15 in. in diameter. The stamens are red at the base, whilst the foliage is green and very dentate. This species is thought by many to be a variety of *Lotus*, but the two are quite distinct in flower, foliage and growth. *dentata grandiflora* is a larger-flowered form of the type, introduced by Sturtevant. *dentata magnifica* has large white flowers with purplish-brown spots near the base of the yellow stamens: it was originally introduced by Bisset. *dentata superba* (Juno) is, in our opinion, perhaps the finest white tender water-lily we have. The bright yellow stamens serve to accentuate the glistening purity of the flower. The variety is remarkable in that it comes true from seed.

divaricata, collected by Hutchinson on General Smuts' expedition to N. Rhodesia in 1930. The plant is peculiar inasmuch as all the leaves are submerged 2 or 3 in. below the water surface and are bilobed. The flowers are pale blue, borne sometimes below and at times on the surface and the species will grow in deep water.

elegans (Señorita Water-lily) is of a delicate lavender-blue shade with golden stamens tipped with blue. It is very free, but the flowers are small, rarely more than 3 or 4 in. across. It hails from Mexico and Texas.

flavo-virens (Frog Water-lily) from Mexico gives handsome white stellate flowers, lily-of-the-valley scented, 12 to 15 in. above water level.

gardneriana is an unimportant species from Tropical America, with small reddish flowers about 3 in. across.

gibertii from Paraguay bears small white, scentless flowers 2 to 3 in. across.

gigantea. This giant form from Australia is one of the finest of the day-flowering species, bearing immense sky-blue flowers anything up to 1 ft. in diameter. It lends itself to outdoor cultivation, and was flowered outside, in heated water, at Glasnevin in 1865. *gigantea forma media* is similar to the preceding, but very much smaller. *gigantea* var. *violacea* is a smaller but darker flowered form.

gracilis with large white flowers is often thought to be synonymous with *flavo-virens*. This species crossed with *zanzibariensis* has given some of our finest garden hybrids. There is also a *gracilis rubra* and *gracilis rosea* which are red and pink varieties of the type. *gracilis azurea* and *gracilis purpurea*, light blue and rich purple respectively, are very fine garden forms introduced by Sturtevant.

heudelotii from Central Africa bears tiny bluish-white flowers. It is of no great garden value. *heudelotii nana* (Baumii) is the smallest tropical Nymphaea, with leaves only 2 in. across and tiny white flowers.

jamesoniana from Ecuador has small brownish-yellow flowers and green leaves with a purple under-surface.

lasiophylla from Brazil bears white stellate flowers 3 to 4 in. across. Unimportant horticulturally.

Lotus of Egypt and Africa is the White Lotus of the Nile. It is also found in thermal springs in Hungary (*thermalis*), where it appears to have survived from very early times. The seeds and tubers are eaten as food in Africa. The flowers are really handsome, they are 5 to 10 in. across, opening at night and delightfully scented. *Lotus* var. *pubescens* is distributed throughout British India, Philippines, Java and Australia. It bears small white flowers

with green stamens and is sweetly scented. The seeds and tubers are used as food in India.

micrantha. Very like *N. cærulea*, the most striking difference lying in the viviparous habit—a feature which does not appear until the plant is at least two years old. Flowers bluish-white; leaves small, rounded, under-surface reddish. W. African coast swamps. This species is easily grown in a shallow bowl. Syn. *N. vivipara*.

ovalifolia from East Africa has small deep blue flowers.

oxypetala, a very rare species from Ecuador, looks more like a Passion flower than a water-lily. We have seen specimens in the British Museum and the flowers appear large and of unusual shape, but it is impossible to tell the colour from these dried blooms and we can trace no literature concerning them. The leaves grow submerged below the water.

polychroma. In 1936 this beautiful species was grown at Kew from seed sent from the Berlin Botanic Garden under the name of *N. colorata*, from which species it appeared to differ in several botanical details but under similar cultivation appears to be identical. It has proved adaptable to indoor cultivation and can be seen at Kew and in the Oxford Botanic gardens. The plant is distinct from all other species, having a rhizome more or less horizontal, which bears numerous 'eyes' that become detached and propagate the plant vegetatively. The flowers are large, bright blue with a slight mauvish tint, accentuated by deep violet anthers. It was discovered by Peter in 1928 in Tanganyika Territory.

primulina, discovered with *divaricata* on General Smuts' Rhodesian expedition. Flowers primrose-yellow, larger than *sulphurea* and borne above the water; leaves purplish.

rubra is a very beautiful night-flowering species from India and Brazil. The flowers measure 6 to 10 in. across and are bright red with cinnabar stamens; the foliage is bronze-crimson, but becomes green with age. This lovely plant is rarely seen in cultivation although a garden form known as *rubra rosea* is occasionally met with. *Nymphaea rubra* is the parent of *Devoniensis*, a beautiful hybrid raised at Chatsworth in 1851 and named in honour of the Duke of Devonshire. The flowers are larger than the type, being 8 to 12 in. in diameter and of a bright rosy-red shade. It blooms freely, the flowers standing well out of the water, and has most attractive bronze-red foliage.

rudgeana, a nocturnal species with small greenish-white flowers, which comes from South American and Jamaica. It is lemon-scented.

scutifolia. Although many authorities give *scutifolia* as synonymous with *capensis*, we maintain it to be a distinct species on account of the dissimilarity of rootstock between the two species. About 1896-97 Mr. Perry received 3 plants of a blue water-lily, under the name of *scutifolia*, from Chas. Ayres of Cape Town. The plants had rhizomatous roots instead of the usual bulbous tubers, and were grown and flowered that season at the nurseries. Eventually the stock was sold and in spite of many enquiries we have never yet been able to trace again this rhizomatous blue water-lily: nor can we find records of anyone else having done so. The tuber was thick and horizontal, resembling a Nuphar in that the old leaf-scars were very prominent. The flowers were blue, somewhat like those of *stellata*.

stellata, from South-Eastern Asia, Java, the Philippines and Africa, bears stellate, light blue flowers similar but inferior to *cærulea*. *stellata* Berlin var. is the finest of many forms raised from *stellata*, and bears large flowers of a uniform sky-blue shade. It will grow outside in a heated tank and is planted out of doors regularly at Exbury.

stellata rosea is a fine variety of the type with soft rose-coloured flowers.

stellata versicolor is a pink-flowered form from India.

stenaspidota, a Brazilian species with dark crimson flowers of a good size in relation to the plant, which is small.

stuhlmannii is an African species collected by Stuhlmann in 1890 and bears bright yellow flowers with orange stamens and yellow anthers. They are large and sweet scented.

sulfurea is a sweet-scented yellow-flowered form from Tropical Africa. It is not in cultivation.

tenerinervia, collected in Brazil in 1819, has small stellate flowers. We have only seen the dried specimens and they give no indication of the colour.

vivipara, see *micrantha*.

zenkeri bears small white flowers, 2 to 3 in. across. It was discovered in the Cameroons.

DAY-FLOWERING HYBRIDS

Name in brackets denotes the raiser.

A. Siebert (Henkel, 1907) is a very free-flowering variety with delightful rose blooms.

Amethyst (Henkel) is a viviparous variety with flowers of a true amethyst-blue shade.

Antoinette Chaize (Lagrange, 1908) bears lavender-blue flowers which are a distinct gentian shade at the tips of the petals.

August Koch (Koch). A viviparous variety useful for the indoor pool owing to the continuous bloom throughout summer and winter. The flowers, of a very pleasing shade of blue, are frequently 7 to 8 in. in diameter and make good cut blooms.

B. C. Berry is a striking shade of ruby-crimson.

Berolina has deep blue flowers and is very free.

Blue Beauty (Pennsylvania) (Botanic Gardens, University of Pennsylvania). An old variety (derived from a cross between *cærulea* and *zanzibariensis*) with deep blue flowers 10 to 12 in. across; the yellow disc in the centre of the flower is surrounded by golden stamens, the tops of these being surmounted by violet anthers.

Blue Bird (Tricker). A viviparous form with very fine flowers of a deep blue shade.

Blue Triumph (Johnson) bears exceedingly large flowers, often over 12 in. across. The plant is most floriferous and has green foliage flecked with bronze.

capensis forma rubra is a fine subject for tub culture; the flowers are brilliant rose with a delicious perfume.

Castalliflora was obtained by Pring in 1913 from crossing two pink forms of *zanzibariensis rosea*. The flowers are light pink, 8 to 10 in. in diameter and bear yellow stamens with pink appendices. The foliage is much serrated, green slightly mottled with red.

Chicago (Koch), clear pink.

Cleveland (Johnson) has fragrant, rich rose-pink flowers and mottled foliage.

Colonel Lindbergh (Tricker, 1929) carries deep cerulean flowers well above water level. This variety is one of the finest in cultivation and we can heartily recommend it both for beauty of flower and fragrance.

Daubeyana (Dauben) is the best known viviparous form, with small leaves and tiny blue flowers. It is very free but succeeds best in shallow water, about 3 or 4 in.

eastonensis (Ames, 1895) has steel-blue flowers and serrated foliage.

Edward C. Elliott (Pring, 1923) carries very lovely pale pink flowers with yellow stamens tipped with pink; frequently 8 to 10 in. in diameter.

Emily Grant Hutchings (Tower Grove Park, Missouri) produces bell-shaped flowers of an amaranth shade.

François Treyve (Lagrange, 1910). Indigo blue; very free.

General Pershing (Pring, 1917) has large fragrant flowers of a warm pink shade; the yellow stamens are lightly tipped with rose.

Governor Luis Emerson (Koch) has pale blue flowers and spotted foliage.

Grossherzog Ernst Ludwig (Henkel, 1907) is a blue variety of the *stellata* type.

Gzetta Jewel is a vigorous variety with large clear pink flowers.

Henkeliana bears strikingly flat flowers; they are of a blue shade with the sweet odour of violets.

Henry Shaw (Pring, 1917) bears open, saucer-shaped flowers of a light campanula-blue shade and green foliage. This variety we consider one of the finest of all the day-bloomers.

Independence (Tricker) is an unusual viviparous form because it has rich pink flowers instead of the blue generally found in this class.

Independence Blue (Tricker) is similar but with blue flowers.

Janice (Tricker, 1928) is the only viviparous form, to date, with white flowers. They are campanulate and very attractive.

Jupiter has very fragrant, deep purple flowers of large size and firm texture.

Listeri has rich blue flowers.

L. Dittmann is a vigorous rosy-flowered hybrid.

Madame Abel Chatenay (Lagrange, 1908) has lavender-blue flowers and mottled foliage.

Madame Herbert Cutbush (Lagrange) is an attractive variety with long tapering flowers of an ageratum-blue shade.

Madame Le Page Viger (Lagrange) bears blush-pink blooms with deep rose edges to the petals.

Marmorata is a sport from *Mrs. Whitaker* with spotted foliage.

Maynardii carries flowers fully 9 in. across, of a lovely shade of pale heliotrope.

Micheliana has rosy-lilac flowers.

Mrs. C. W. Ward has rich rose-pink flowers borne well above water level. It is a charming variety with the inner disc well clothed with golden stamens.

Mrs. Edwards Whitaker (Pring, 1917) is one of the most striking of all the day-blooming lilies. The pale lavender flowers are over a foot across, the bright yellow stamens forming a pleasing contrast. It may be grown quite well in a tub.

Mrs. George Pring (Pring, 1922). A counterpart of the preceding form in pure white. The flowers are stellate and 8 to 10 in. across.

Mrs. Woodrow Wilson is a viviparous variety with lavender-blue flowers of large size and firm texture; the foliage is green.

Mrs. Woodrow Wilson var. *gigantea* (Pring) has large sky-blue flowers, darker than the parent, and very fragrant.

Mrs. W. R. James (Koch) has fragrant deep pink flowers.

Pamela is sky-blue with mottled foliage.

Panama Pacific (Tricker). A viviparous variety of most unusual coloration. The flowers open a wine-blue shade, turning later to a deep royal purple; whilst the yellow stamens are tipped with purple. This is an easily-grown tender water-lily and one of the most attractive.

Patricia is a crimson-flowered viviparous form.

Pink Delight (Johnson, 1934) is rose-carmine.

Pink Pearl has bright silver-pink flowers.

pulcherrima (Tricker, 1897), a hybrid of *Nymphaea carulea* with *capensis*, which grows very freely and produces light blue flowers 6 to 12 in. in diameter. The sepals are heavily spotted with black and the stamens yellow with blue appendices.

Royal Purple is a viviparous form with growing purple flowers.

Reine d'Italie is of a Tyrolean purple shade with strawberry-red stamens.

Stella Gurney has large stellate, light pink flowers.

St. Louis (Pring, 1930) has the distinction of being the only tropical garden variety of a yellow shade. The flowers are stellate, of a good size and brightly coloured, whilst the foliage is heavily mottled with bronze.

William Stone (Tricker) is an outstanding variety with large violet-blue flowers shaded amaranth. They are open all day long and stand well above water level.

William Ward is a hybrid from *zanzibariensis* with large rose flowers.

NIGHT-FLOWERING HYBRIDS

Adele has magenta-carmine flowers.

Albert d'Argence is red magenta with orange-red stamens.

Armand Millet has very large flowers of a brilliant reddish-purple shade, and green dentate foliage.

Arnoldiana is rosy-carmine.

Bissetii (Bisset) produces cup-shaped flowers 8 to 10 in. across, quite double and of a glowing rose colour; also bronze-red leaves with serrated edges.

Boucheana has rosy-pink flowers with broad flat petals.

columbiana has deep dark red flowers.

Deaniana (Tricker, 1894) has cup-shaped flowers of a clear pink shade, with yellow stamens.

Delicatissima has light pink flowers and metallic foliage.

Diana is rosy-carmine.

Diana grandiflora produces blooms of a carmine-red shade.

Doctor Florenze is dark red.

Frank Trelease (Gurney, 1900) is very popular on account of its deep colour. The flowers, of a rich dark crimson shade, measure 8 to 10 in. across and have deep reddish-brown stamens. The plant is inclined to be shy-flowering.

George Huster (Dreer, 1899) is one of the finest of all the tropical varieties with deep velvety-crimson blooms. When seen by artificial light the red night-blooming lilies glow with a richness of colour that is well-nigh indescribable.

H. C. Haarstick (Tower Park, Missouri) bears copper-coloured leaves and well-shaped flowers of a brilliant red shade.

indica Bhrama has fiery-rose flowers.

indica Hofgartendirektor Graebner produces deep rose-coloured flowers with concave petals; they are deeper in hue towards the centre. The large reddish-brown foliage is very attractive and deeply serrated.

indica Isis is delicate pink.

indica Spira has rosy-pink flowers with broad concave petals.

James Gurney Jnr. has crimson flowers which pass with age to a deep purplish-crimson shade.

Jubilee has deeply dentate foliage and pure white flowers 6 to 8 in. across. The sepals and petals are faintly tinged with pink at the base.

Jules Vacherot (Lagrange) is a very free variety with flaming red blooms.

kewensis. This variety, raised at Kew about 1885, is still in cultivation both in this country and America. It bears delicate pink flowers and green foliage mottled with brown.

Krumbiegelii is carmine-red.

Laelia produces flowers of a delicate pink shade.

Laelia colorans is similar to preceding but the flowers are deeper in colour.

La Reine de Los Angeles (Johnson, 1935) has glistening white flowers with very broad petals, frequently 10 in. in diameter.

Madame Auguste Tezier (Lagrange, 1914) is of unique colouring. The blooms are violet-heliotrope in the centre, which becomes paler in shade towards the outside petals and sepals. The stamens are brown and the foliage purple, very dentate and spotted with brown on the under-surface.

Marie Lagrange (Lagrange) is rose-purple with prominent white lines running down the centres of the petals; yellow stamens.

Mars (Johnson, 1933) is of a bright rose-vermilion shade.

Minerva has large cup-shaped flowers of fine texture; they are pure white.

Missouri (Pring, 1933) is one of the finest of the white-flowering hybrids introduced in recent years: opening 4 to 5 nights in succession. It is very free, of strong constitution, whilst the flowers are 10 to 14 in. across and stand well out of the water.

Mrs. George C. Hitchcock (Pring, 1926) carries large rose-pink flowers.

Niobe is magenta-carmine.

O'Marana (Bisset) bears flowers 10 to 12 in. in diameter, of a rosy-red shade with a faint white line running down the centre of each petal. The stamens are deep orange and the foliage green with crumpled edges. This is one of the finest and freest nocturnal-flowering hybrids.

Ortgiesiana alba (Ortgies) has large open flowers of a soft

creamy-white shade with a striking purple base; the sepals are striped with green.

Ortgiesiana rubra (Ortgies). Although introduced as long ago as 1852, this pretty variety is still in cultivation. The flowers are of a clear pink shade and very free.

President Girard is rosy-carmine.

Pride of California (Johnson, 1935) is a free-flowering variety with blood-red blooms. They are of good shape and thrust well above water level.

purpurea is dark purplish-red.

Rufus J. Lackland opens a crimson shade and darkens with age to a deep purplish hue.

Smithiana produces creamy-white flowers with yellow stamens.

Sturtevantii (Sturtevant) has deep bronzy foliage, which is in the early stages almost crimson. The flowers are very large and of a beautiful rosy-red shade; the plant requires good feeding.

Tanganyika is a new white form offered by Johnson. We do not know the plant, but it may be a species, as he states that it was imported from Africa.

VICTORIA REGIA

No discourse on tender water-lilies is complete without some account of the *Victoria Regia*, that giant aquatic with foliage so enormous that it outstrips in size any other floating leaves in the vegetable kingdom.

The plant was first found in Bolivia, by Haenke in 1801, and although rediscovered on different occasions by various travellers after that date, it was not until 1838, when Dr. Lindley drew up a descriptive account, that its existence became known to the world at large. Lindley named it *Victoria Regia* in honour of the late Queen Victoria, and described it as a 'water-lily, exhibiting a new type of structure, of the most noble aspect, of the richest colours, and so gigantic that its leaves measure above 18 ft., and its flowers nearly 4 ft. in circumference'. In 1840 Bridges sent seeds to Kew, three of which germinated but failed to survive the winter. After several unsuccessful attempts, Mr. Paxton, in 1849, managed to obtain a flower at Chatsworth; and from this plant seed was distributed throughout Europe, and a craze commenced for cultivating the *Victoria*.

A good deal of discussion has taken place as to the correct

appellation of the plant, for, whilst all authorities are agreed that it was so named in honour of the Queen, yet there is some diversity of opinion as to whether it should be *Regina* or *Regia*. Mr. Gray in *Annals of Natural History*, vol. vi, is emphatic that the former word is correct. He says 'the name of *Victoria Regina*, which received the sanction of Her Majesty, was the one first used and published, and has the undoubted right of priority', and considers that the other name, more recently adopted, was apparently the result of a typographical error. *Index Kewensis*, however, uses the word *Regia*, as does Dr. Lindley in his original description in the *Botanical Register* in 1838.

The *Victoria* is known locally by different native tribes, under various names, such as Yrupe, Morinqua, Dachoch, Irupe and Murura. Yrupe, literally translated, means Water-Platter—surely an excellent title, for the leaves lie quite flat on the surface, with upturned edges from 2 to 8 in. high at right angles to the water. They are extraordinarily tough and strong, and this is probably the reason why so many illustrations portray a small child (invariably in Victorian dress) standing or squatting on one of the leaves. We have even read an account of a young lady using one as a boat, after a thin board had been laid over the surface, more evenly to distribute the weight.

The flower is nocturnal, and opens a creamy-white shade, changing to pink and then purplish-red through successive nights. It is fragrant, with a sweet odour like that of pineapple, which is noticeable at some distance from the plant. The fruit is about half the size of a man's head, thickly protected (as are the flower and leaf stalks) with strong spines. The natives of some districts believe these prickles to be of a venomous nature and so avoid the plant, but others, less credulous, go to some pains to gather the fruit. The hard, shiny seeds are soft and mealy within, so that the Indians hold them in great esteem as an article of diet, calling them 'Water Maize' or 'Water Corn'. Possibly the roots have the nutritive properties of other *Nymphaeas*, but they do not seem to use these—probably owing to the difficulties of raising them from 6 ft. or more of water.

Very few gardeners in this country will attempt to grow the Victorias, but, nevertheless, the method of cultivation may be of interest. Although a perennial, it is best when treated as an annual, and at Kew fresh stocks are raised each year. The seeds are sown

in shallow pots of loam stood in pans of water, about January or February, in a temperature round about 85° . Before sowing, the hard outer coat is filed through to hasten germination, as is often done with *Canna* seed. They need plenty of light, so are given an open position and are potted on from time to time in accordance with the increase in growth. The heated tank for their ultimate reception must be in the sunniest possible position, and contain a good rich planting compost.

Lawson observed, 'It is a curious fact connected with *Victoria*, and one which has important bearings on its cultivation, that, although an aquatic plant, it will not grow within the influence of the sea breeze, nor in water having the least mixture of saline particles.' Whilst we have had no opportunity of testing this statement, attention should be given to the purity of the water, and the use of sea sand or shingle in the compost be avoided.

Another species which was named *Victoria Cruziana* in honour of General Santa Cruz of Bolivia, by D'Orbigny, in 1840, requires less heat than *Regia* and will succeed in a temperature round about 70° or 75° . It is similar in appearance to that species but flowers earlier, and the foliage is lighter green with purple under-surfaces. This plant, introduced into American gardens about 1894, is often sent out under the name of *Trickeri*.

Cruziana mattogrossensis is a form from Matto Grosso, where the tributaries of the Amazon and the Panama rivers interlace. It does not appear to be in cultivation.

In 1886, Sturtevant of North America flowered a plant raised from seed sent him by Mr. Rand of Brazil. This proved quite distinct from either *Regia* or *Cruziana* and was named *Randi*. The foliage is of a reddish colour with very prominent red veins, and the flowers white passing to deep crimson: the transition takes place much more quickly than it does in *Regia*.

EURYALE FEROX

Until the discovery of the Victorias, the Gorgon plant or *Euryale ferox* was thought to be the largest and most handsome aquatic plant. It is a native of India, and similar to these water-lilies except that the leaves do not turn up at the edges. They are from 2 to 3 ft. in diameter, whilst the flowers are small, rarely more than 2 in. across, of a blue-violet shade. The seeds are farinaceous and much esteemed by the natives when baked. The

Hindu physician, too, considers them possessed of powerful medicinal virtues, and prepares from them tonics to invigorate the system. The Chinese also use the seeds, which are about the size of peas, as food, and are said to have cultivated the plant for upwards of 3,000 years. It is perennial and cultivated in the same manner as the Victorias.

CHAPTER VII

Nelumbos and Nuphars

But heavily pensive on the lotus lay,
That blossom'd at his touch, and shed a golden ray,
Hail, primal blossom! hail, empyreal gem!

FROM A HINDU POEM

NELUMBOS (*Nelumbium*; *Cyamus*; *Tamara*)

FROM EARLIEST times it has been customary for man to select certain plants of beautiful habit or economic value as worthy of the greatest veneration. Such a distinction has been accorded to the Lotus, which is an object of adoration in many parts of the world. It was greatly revered in ancient Egypt, India, Tiber, Japan and China, and is still used in religious ceremonies in certain of these countries.

At the same time, there seems to be considerable doubt in the minds of modern writers as to whether *Nelumbo nucifera*, hitherto acknowledged to be the Sacred Lotus of the Nile, is the Lotus portrayed in their art and sculpture: or whether *Nymphaea Lotus* and *Nymphaea cærulea* (the former white, the latter blue) are the plants represented. To give substance to their theory, they point out that both these plants are indigenous to Egypt, and *Nelumbo nucifera* was introduced into Egypt from India, its native home, centuries ago, probably somewhere about 525 B.C. (time of the Persian invasion).

Herodotus describes it as the Rose Lily and, speaking of the Egyptians, says, 'But to obtain food more easily, they have the following inventions. When the river is full, and has made the plains like a sea, great numbers of lilies, which the Egyptians call Lotus, spring up in the water; these they gather and dry in the sun; then having pounded the middle of the Lotus, which resembles a poppy, they make bread of it and bake it. The root also of this Lotus is fit for food, and is tolerably sweet, and is round and of the size of an apple. There are also other lilies, like roses, that grow in the river, the fruit of which is contained in a separate pod that springs up from the root, in form very like a wasps' nest; in this there are many berries fit to be eaten, of the

size of an olive-stone and they are eaten both fresh and dried.' These latter lilies which he describes can only be *Nelumbos*. The habit of making bread and the mode of sowing, which consisted of enclosing each seed in a ball of clay and throwing it into the water, is thought to have been referred to in the text, 'Cast thy bread upon the waters, for thou shalt find it after many days.'

From the *Nymphaeas* or true water-lilies, *Nelumbos* differ fundamentally by having distinct carpels, each bearing a single ovule; and in general appearance by the large, round leaves which are borne aloft several feet out of the water. In the young state, or in very deep water, these may float, the upper leaf-surface being covered with a protective coating of wax, which keeps them perfectly dry in the most inclement weather; it is fascinating to watch the raindrops run from the smooth surface like globules of mercury. The foliage is quite round and entire, of a glaucous-green colour (due to the waxen veneer) and with the petiole placed almost in the centre, as in the common *Tropaeolum*.

The flowers are usually very large and showy, in general appearance not unlike a full-blown rose or paeony. They may be single or double, with erect or spreading petals, and bear four to five sepals and numerous golden stamens. The seed pod is very attractive; it is something like a large poppy head, and used occasionally in winter bouquets.

Nelumbos are reproduced by means of long creeping root-stocks, which may run 20 or 30 ft. in a season! For this reason, they should always be confined in some receptacle and given a good rich planting compost. The smaller kinds may be conveniently grown in tubs: they will do well and send up a number of blooms during the season, but embryo seed pods should be removed to encourage flower growth. A layer of well-rotted cow manure should be spread over the bottom, followed by 12 to 15 in. of good loam. This must be firmly rammed, and the tuber placed in a horizontal position and barely covered with soil. The tub may then be filled with water, and, if necessary, a stone or some such weight placed over the tuber to keep it down. The tub may be stood outside for the summer months, or left in the greenhouse. In the autumn, when the foliage commences to wither, the water should be reduced and the tubs packed out of the way for the winter. *Nelumbos* are occasionally grown out of doors in this country, but rarely successfully; our normal summers do not seem

to be warm enough to ripen the tubers, and they invariably rot away during the winter.

Being rich in economic value, the plant is cultivated in the Orient for the food value of the roots and seeds, which are rich in farinaceous matter. The seeds form an ingredient of soups and many other Japanese and Chinese dishes; it is possible to buy them candied in London. The leaf stalks abound in spiral fibres which are carefully extracted and used as lamp wicks to burn before idols. The stems are also eaten among other pot-herbs, and the rhizomes too form an important article of diet. In China it is called Lien-Wha, and a dish prepared from seeds and slices of the root, mixed with the kernels of apricots, walnuts, and alternate layers of ice, is frequently placed before British Ambassadors and members of their suite, at some of the breakfasts given by the principal Mandarins. The roots are also preserved in salt and vinegar for the winter, so that there may always be a stock in reserve.

The large fleshy roots of the North American *Nelumbo lutea* resemble the sweet potato (*Batatas edulis*) and are eaten by the Indians and some of the Tartar tribes. The Hindus still make domestic use of the Lotus, as they cover their tables with the larger leaves and eat their food from the smaller ones; whilst the stranger is presented with fruit and flowers laid in a simple basket fashioned from Nelumbo leaves. In India, the plant is held sacred by the Hindus, who compare their country to a Lotus flower; the petals representing Central India and the leaves comparable to the surrounding divisions of the country; incidentally, the Order of the Star of India is comprised of a Lotus flower, the Rose of England and two Palm branches crossed. It was used as an ingredient in the love philtres of the Indians, and we find that nearly every part of the body has, at some time or another, been compared by their poets to the Lotus.

Fossil remains of the Nelumbo are abundant, and its presence has been established as far back as the Cretaceous period. At one time it appears to have been plentiful in Europe, but has now disappeared. Change in climatic conditions doubtless spelt its death warrant, or it was dug up on account of its edible tubers. Whatever the cause, it is now a stranger to these habitats, and no longer indigenous to Europe.

Nelumbo lutea (*Nelumbium luteum*) (Duck Acorn; Water Chinkapin) is the native North American Lotus found in stag-

nant pools from South Ontario to Minnesota. It is of easy cultivation, and hardy in favoured localities where sufficient sun heat is available to ripen the tubers. The leaves, standing 2 ft. 6 in. out of the water, are 1 to 2 ft. across; whilst the flowers, 4 to 10 in. in diameter, are of a uniform shade of pale sulphur-yellow. Unfortunately the species does not flower freely until well established, and patience is required for five or six years after planting before obtaining the full quota of blossom.

lutea var. *flavescens*. Introduced by Marliac, this variety produces more but smaller flowers and has a red spot at the centre of the leaves.

nucifera (*Nelumbium speciosum*; *indica*) (Hindu Lotus). This species bears beautiful flowers, about 12 in. across, of a vivid rose colour turning paler in shade as the blooms age. The leaves stand well out of the water and are deep green above, with a silver metallic sheen. The plant has a wide distribution, being found in India, the Philippines, North Australia and Japan. It is not a native of the Nile.

nucifera var. *alba*, the Magnolian Lotus, is a white form of the type.

nucifera var. *alba grandiflora* (*alba floribunda*) bears large fragrant flowers, 12 in. or more in diameter. The leaves are large and of a deep green colour. This variety is generally considered the best of the single whites.

nucifera var. *alba plena* (Shiroman). This magnificent Japanese variety gives large, double creamy flowers on opening, which become paler as the flowers age, until the third day, when the blooms are pure white. They are very fragrant, and plentifully produced throughout the summer months.

nucifera var. *alba striata* (Empress) bears pure white flowers, with the edges of the petals striped and tipped with red. It is a vigorous grower and the blooms, which last well when cut, are fragrant.

nucifera var. *alba virens*. Introduced by Sturtevant in 1907, this variety throws double, cup-shaped flowers of a pure white shade, tinted and striped with sea-green. This tends to fade out with age, so that the mature bloom becomes pure white.

nucifera var. *gigantea* bears exceptionally large flowers of a rich rosy-purple shade. The leaves are deep green above, light silvery-green on the reverse.

Grossherzog Ernst Ludwig (flavescens × Osiris), raised by Dittmann, is a German hybrid of outstanding excellence. The large globular blooms open a rich rose shade, with yellow stamens and light green ovaries. These shades in conjunction produce a delightful and distinctive coloration feature. The foliage is glaucous-green.

japonica rosea has large double flowers, white heavily overlaid with rose. The foliage, 12 to 15 in. across, is of a glaucous-green colour.

Kermesiana. A Japanese variety with light rose blooms and large round leaves.

Kinshiren is a free-flowering Japanese form with white flowers flushed with pink.

Madame Paufique bears white flowers suffused with carmine.

Osiris. One of the Marliac's varieties with cup-shaped flowers 8 to 10 in. in diameter, of a deep rose colour, and bluish foliage.

pekinensis rubra (Peking) is one of the darkest coloured forms in cultivation. The flowers are large, of a bright rosy-carmine shade and very fragrant. The foliage is handsome and the plant free in growth and flower.

pekinensis rubra plena (Red Peking) resembles the parent in growth and colour, but has double flowers instead of single.

pulchra, another Marliac variety, bears very large flowers 12 in. or more in diameter, of a deep rosy-lilac shade bordered and lined with red. It is free-flowering and of strong constitution.

pygmæa alba is a miniature variety, dwarf both in flower and foliage. The leaves never grow more than 18 in. above the water and are only 5 or 6 in. across. The flowers, 5 to 6 in. in diameter, are pure white.

pygmæa alba plena is a double-flowered form of the preceding.

pygmæa rosea, also a dwarf variety, bears small bright rose blooms. All the pygmy forms are useful for tub cultivation.

rosea (Dawn) carries flowers of a deep rosy-pink colour.

rosea plena (Double Dawn) is very double, bearing 80 or more petals of a deep rosy-pink shade. The plant is free-flowering and very robust.

violacea, a Marliac form bearing deep purplish-red flowers lightly streaked with white. It is less free than some of the varieties.



NELUMBO NUCIFERA



CERTAIN OF THE NELUMBOS ARE ADMIRABLY SUITED
TO TUB CULTURE



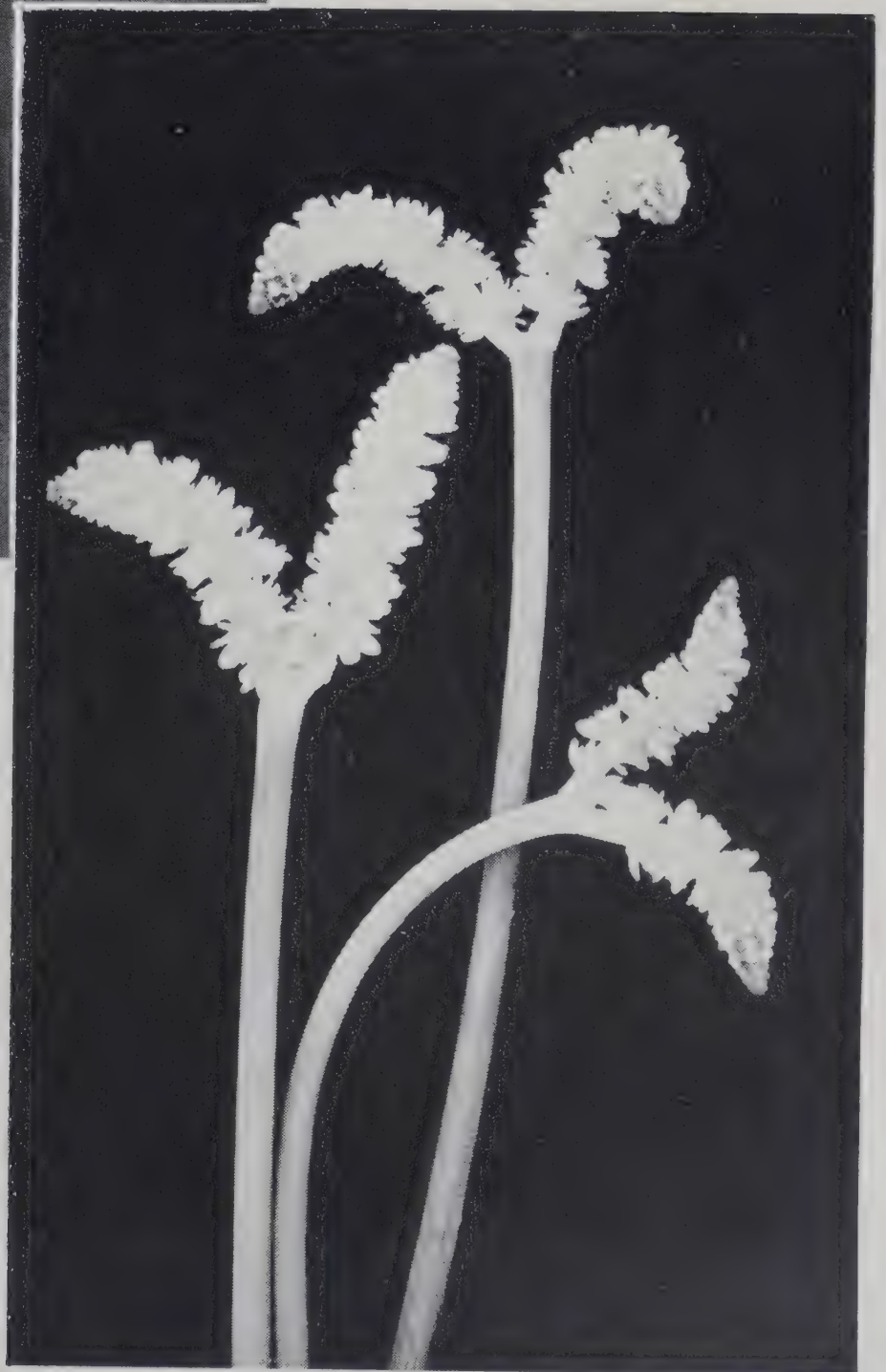
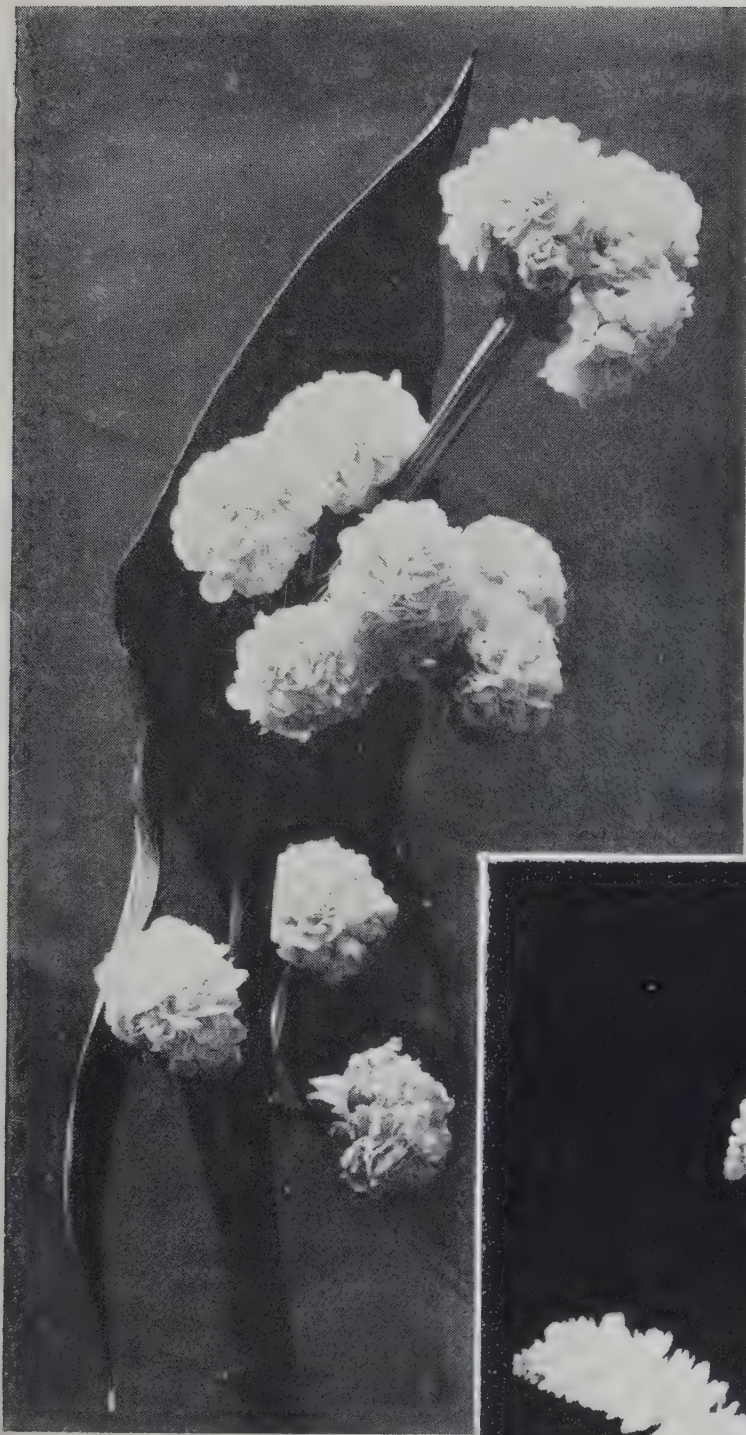
APONOGETON DISTACHYUM



NYMPHAEAS AND APONOGETONS AT WISLEY

Wisteria sinensis makes an effective draping for the bridge in the background

SAGITTARIA SAGITTIFOLIA VAR
JAPONICA FLORE PLENO



APONOGETON
KRAUSEANUM



THALIA DEALBATA MAKES A DIGNIFIED WATERSIDE SUBJECT

NUPHARS

Nuphar is a genus of hardy, strong-growing plants, akin but inferior to the hardy water-lilies. They will thrive in shade or sunshine, still or running water; and the bold, green foliage affords admirable shelter to the aquatic creatures beneath. The flowers, however, are far less richly endowed by nature, so that the poorest *Nymphaea* is finer than any Nuphar: but compensation lies in the fact that the Yellow Pond Lily will flourish in places where one could never hope to succeed with the water-lily. Some of the forms have beautiful submerged leaves; they are crisp and curled, membranous and translucent—a feature which the aquarist makes use of by planting them freely in the largest of his fish tanks and aquariums. The flowers stand just above the water and are single, with five or more purplish or yellowish, concave sepals. This constitutes the showy part of the plant, for, although the petals are numerous, they simulate stamens and are not particularly noticeable. The ovary is short, 8 to 24 stigmas forming rays at the top, giving the interior somewhat the appearance of a poppy-head.

Nuphars should be cultivated in exactly the same way as *Nymphaeas*, and, although they will thrive in 4 to 6 ft. of water, succeed best in 6 to 12 in. They form a coarse rhizomatous root, sometimes green, but generally white with brown markings; this must be firmly fixed so that it does not float to the surface after planting. Although, as already stated, the Yellow Pond Lilies will flourish in shady positions, flowers are only produced when the plant receives full benefit of the sunlight—a feature which must be borne in mind if an abundance of bloom is desired.

Most of the Nuphars are native to North America, where they grow in stagnant pools or along the margins of slow-running streams: but the genus is also represented in Europe and Asia. The generic name is a mediaeval Latin contraction of *nenuphar*, derived from *Noufar* or *Nylowfar*, the Arabic term for *Nymphaea*; American works of reference frequently refer to the Yellow Pond Lily as *Nymphaea*, assigning that genus to *Castalia*.

The family is not without economic value. Linnaeus stated that swine and goats will eat the leaves and roots, but that sheep, horses and cattle refuse it: also that crickets are driven out of the house by the smoke caused by burning it on the hearth, and that

both they and cockroaches are destroyed by partaking of an infusion of the bruised roots in milk.

All parts of the plant contain tannic acid, but more especially the rootstocks, and those are useful in tanning. The leaves have been used as a styptic, and an infusion of the roots in water was long considered an excellent remedy for eruptive diseases of the skin. The rootstocks contain a considerable quantity of starch, which renders them so nutritious that they are frequently powdered and turned into bread in Sweden. It is said that, mingled with the inner bark of the Scots Pine, the flour forms a cake much relished by the Swedes. The Greeks prepare a cordial from the flowers of *Nuphar luteum* which they call Pufer—probably a corrupted version of the generic name.

advenum (Common Spatterdock) is one of the best of the genus, equally adapted for stagnant or running water. It has large, thick leaves about a foot in length, of a roundish to oblong shape with a widely-opened sinus. They stand right out of the water and submerged foliage is rarely produced. The flowers are 2 to 3 in. across, of a globular shape, and their yellow hue is tinged with green or purple. The stigma is yellow or pale red. It flowers from May till September and is a native of North America.

advenum variegatum, with floating, variegated leaves (none erect) and purplish-yellow flowers, is a variety of the type found in British Columbia.

intermedium is presumably a natural hybrid between *luteum* and *pumilum* (although some writers quote it as a species) for it bears certain characteristics of each. It is found in Central and Eastern Europe, and carries small, yellow flowers 1 to 2 in. in diameter and green cordate foliage.

japonicum bears large, crisped submerged leaves, and long, arrow-shaped floating ones. The yellow flowers are 2 to 3 in. across. It is a native of Japan and should be planted in still water.

japonicum var. *rubrotinctum* is perhaps the most handsome of all the Nuphars, with dark olive-green foliage standing erect out of the water, and cup-shaped flowers with red-tipped stamens and orange-scarlet sepals.

japonicum var. *rubrotinctum giganteum* bears larger leaves and flowers than the preceding, but is not quite so vivid in colour.

japonicum variegatum has the fine, erect foliage of the type,

splashed and mottled with creamy-white markings. The flowers are yellow. All these varieties of *japonicum* are of Japanese origin and should be planted in still water.

juratum, a rare species from the Juras with very small leaves and tiny yellow flowers.

kalmianum (microphylla) is a small species from North America with delicate yellow flowers, one inch or less in diameter, and tiny floating leaves. It may be planted in shallow water near the margin of the pool, and quickly becomes naturalised, producing an abundance of flowers. The submerged foliage is pretty and frequently used for aquarium decoration.

luteum is our British representative and widely distributed throughout Europe. The flowers are smaller than in *advenum*, and yellow, with a strong alcoholic smell—a peculiarity which has given rise to the local name of Brandy Bottle. It grows well in running water—even as much as 8 ft. in depth—and produces very fine transparent underwater foliage.

luteum punctatum has the upper and lower leaf-blades punctuated with small brown cells.

luteum var. *purpureosignatum*. This variety has yellow flowers overlaid with purple markings.

luteum var. *rubropetalum* has reddish flowers.

luteum var. *sericeum* is a Hungarian form similar to the type but with larger and deeper coloured flowers.

luteum var. *sericeum denticulatum*, a variety of preceding with slightly dentate foliage.

macrophyllum is a strong-growing species from the Southern States of America, bearing yellow flowers an inch or less across. The foliage is large and glabrous, oblong-ovate in shape and the rootstock bright green. It will grow in running water.

minimum (pumilum) (Dwarf Pond Lily) is an easily grown and very free-flowering variety eminently suited for shallow rock-garden pools or the pond margin. It is of slender habit, bearing tiny floating leaves with deeply-cut sinus and spreading lobes. The flowers are small, an inch or less in diameter, and pale yellow.

minimum affine is a geographical form with light green foliage and small flowers: it is found in Europe.

orbiculatum is a robust species from the Southern States of the U.S.A. bearing bright green, orbicular floating leaves which are somewhat crisped at the edges. With the exception of the upper

surface of the leaf-blades, the whole plant is pubescent; the flowers are about 2 in. in diameter.

polysepalum is a larger plant than the preceding with leaves much longer than they are broad. These stand erect when the plant is growing in shallow water, but float on the surface if it is deep. The flowers are yellow, 4 to 5 in. across. It is a native of North America.

rubrodiscum (Red-Disked Pond Lily) has membranous submerged foliage, and floating or erect leaves 3 to 10 in. in length. The flowers are 1 in. to $1\frac{1}{2}$ in. across, yellow with a prominent red or crimson inner disc. It is a North American species.

Spennerianum. A natural hybrid between *luteum* and *pumilum* found in the regions of the Juras, forming small yellow flowers and prominent star-shaped ovaries.

CHAPTER VIII

Miscellaneous Aquatics

Where the pool
Eddies away, are tangled mass on mass
The water-weeds, that net the fishes cool,
And scarce allow the narrow stream to pass;
Where spreading crowfoot mars
The drowning nenuphars,
Waving the tassels of her silken grass
Below her silver stars.

ROBERT BRIDGES

THE INFORMAL pool has a flat and uninspiring appearance when simply clothed with water-lilies, so, to create more natural effects, some attempt should be made to break the straight lines and to disguise the rough edges where earth and concrete meet. This is best arranged for by the judicious planting of decorative aquatics; taking into account the propensities of aquatic plants to spread, and not being too lavish at the outset.

It is fairly safe to say that all water plants of a creeping or stoloniferous nature will become a nuisance if not kept under control: with shallow-rooted subjects this matters little, for any superfluous is easily pulled out, but deeper-rooted plants present more difficulties. The best plan is to plant these in large pots or boxes, or to make some sort of pocket through which their roots cannot penetrate; the growing capacities of the plants will thus be confined to the area of the receptacle used.

In the following alphabetical list of plants their requirements are set out as follows:

H after the descriptions denotes hardiness to British winters.

L indicates plants that can be grown outside in summer but must be wintered indoors.

G denotes greenhouse subjects which need the shelter of a house throughout the year.

ACORUS (Araceae) 2 sp. Name from the Greek *Akoron*, name of a plant with aromatic roots or rhizome; probably applied to an Iris.

A useful genus of hardy, herbaceous, water-loving plants noted

for their aromatic and medicinal properties. They are best grown in shallow water or moist loamy soil and are propagated by divisions of the roots in spring.

A. Calamus (Sweet Flag; Beewort). A reed-like plant, having something of the habit of a sedge; growing 2 to 3 ft. high, with broad strap-like leaves, not unlike those of a flag Iris. In the centre is a long stem, from which protrudes, just below the tip, a conical spadix 2 to 3 in. long, densely packed with greenish flowers.

Before the sixteenth century *Acorus Calamus* was known to European writers only as a drug imported from the East. The living plant is now widespread in Europe; whether it is native outside Asia and Eastern North America is, however, extremely doubtful. According to the investigations of Mucke (1908), its introduction into European gardens dates from 1557 when Augier Ghislain Busbecque (1522-1592), a Flemish diplomat in the service of the Holy Roman Emperors Karl V and Ferdinand I, visited Istanbul and adjacent Asia Minor on a mission to the Sultan, Soliman I the Magnificent. His physician, Wilhelm Quackelbeen, collected plants in a lake near Nicomedia, and these were sent to Mattioli at Prague. Charles de l'Ecluse (Clusius) received it at Vienna from Istanbul in 1574. By the end of the sixteenth century it was cultivated in gardens in Belgium, England, France, Germany and Italy as well as in Austria and Bohemia. Gerard had it in his garden in London by 1596. According to Trimen (1817), not until 1660 was *Acorus* reported as growing wild in Norfolk. There is no doubt that in some localities it has been deliberately planted and probably from these has spread to others. The *Acorus* found in Europe does not fruit, which may be because it is all of the same clone, nor does it do so in the older settled parts of North America, to which it has probably been introduced from Europe: in the Northern interior of America, to the east of the Rockies, *e.g.* in Minnesota, where (according to Buell, 1935) it has the appearance of being native, it fruits freely. It is widespread in Southern Asia.

All parts of the plant emit a pleasant scent when crushed with the fingers and have a warm, pungent, bitter taste. The root has been employed in medicine since the days of Hippocrates and is also mentioned in the writings of Theophrastus and Dioscorides. At one time an infusion was used in diseases of the eye, whilst as a stimulant and tonic its properties are well renowned: indeed it is

still used in Lincolnshire as a cure for ague. Dr. Barter wrote of it, 'On dyspeptic flatulence and other disorders of the stomach it merits the attention of the physician: it is a useful adjunct to bitters and stomachic infusions.' C. E. Larter, writing in *Country Life* in 1910, stated that it was a great favourite with sailors, who chew the root and find thereby a pleasant remedy for indigestion, and, by stimulating the salivary glands, a cure for toothache.

He also remarked that it grew so abundantly in Norfolk that as much as £40 per acre had been given for the year's crop for medicinal purposes. The bulk of supplies, however, comes from the Levant, from whence it is shipped to the world's markets: for medicinal purposes the rhizomes are cut up into pieces 4 to 5 in. long and dried. This drying process greatly improves the flavour, and an essential oil obtained by steam distillation is of great and varied importance. Incidentally, the candied roots are sold in Turkey as a sweetmeat, the natives considering them of great value to ward off infection. Infused in liquids it imparts a pleasant flavour and cinnamon odour; Prof. Johnson, in *Chemistry of Common Life*, states that it has been used to give fragrance and taste to certain kinds of beer and gin.

The powdered root is still used for scenting hair pomades, as an ingredient of tooth powders and for coughs, cold, etc. According to Nairne, the crushed plant is so offensive to the cobra as to act as a safeguard against that reptile. North temperate regions. *H.*

A. Calamus var. *variegatus* is more to be desired from a horticultural point of view, for the foliage is attractively variegated in green and cream. It shares the aromatic principles of the type, though not perhaps in such a high degree. *H.*

A. gramineus is a dwarfer and much more slender-growing species, forming compact grassy tufts, 8 to 12 in. high; it should be grown in very shallow water or at the pond edge. Japan. *H.*

A. gramineus var. *pusillus*, a dwarf, growing only a few inches high with narrow sword-shaped leaves and tiny rhizomes, looks quaintly attractive at the pond's edge, in a sink garden or even in the aquarium. We have never seen it flower, but it spreads and may easily be reproduced by divisions. Japan. *H.*

A. gramineus var. *variegatus*. A variegated form of the type, with grassy foliage freely suffused and striped with yellow. *H.*

ALISMA (Alismataceae) 5 sp. Name, the Greek name of the plant. Water Plantain.

A genus of weedy aquatics with acrid rootstocks, plantain-like foliage and whorled panicles of little rosy-lilac flowers. The acrid juices of the family formerly led to their use in medicine and are so intense as to seriously injure cattle that feed on them. The tubers are farinaceous; those of *A. Plantago-aquatica* being at one time confidently recommended in Russia as a remedy for hydrophobia. They have been used for the same purpose in Carolina as a cure for rattlesnake and tetanus poisoning, for, by their peculiar sedative powers, they render the patient completely paralysed. The plants should be grown by the margins of lakes, rivers or ponds and are reproduced by means of seed or division of the rootstock. The old flower heads must be removed at intervals or the young seedlings are apt to become a nuisance.

A. canaliculatum has narrowly lanceolate foliage and loose spikes of pinkish flowers. Japan; China. *H.*

A. gramineum, a plant which will grow as well submerged as on land. When found under water the leaves become elongated and resemble *Vallisneria*, whilst in the land form they lie in a neat rosette and are oblong lanceolate to spoon-shaped. The flowers are borne in crowded whorls and are pinkish-white. Europe; Africa; Asia; North America. *H.*

A. lanceolatum grows 12 to 18 in. high, with slender, oblong lanceolate foliage sharply pointed at the tip, not subcordate at base, and scapes of pinkish-white flowers. Europe, including Britain; North Africa; India; South America. *H.*

A. natans, see *Elisma natans*.

A. Plantago-aquatica (*A. Plantago*; *A. subcordatum*) (Great Water Plantain; Mad Dog Weed) is a free-flowering British aquatic with large stalked leaves, the blade usually broad, subcordate at base, and ribbed like those of a Plantain, with pyramidal panicles of small, delicate, rose-coloured flowers. It is perennial and grows 2 to 3 ft. high. It will only flower in comparatively shallow water. North temperate regions; Australia. *H.*

A. rariflorum. A Japanese species growing 12 in. high, with an inflorescence 18-20 in. in length. The flowers are white and leaves elliptical, sharply pointed at either end. *H.*

Other Alismas are now placed in various genera (*Caldesia*; *Elisma*; *Damasonium*; *Limnophyton*; *Echinodorus*).

ANEMOPSIS (*Saururaceae*) 1 sp. Name from the Greek, referring

to the resemblances between the flower and that of the anemone. Yerba Mansa; Apache Beads.

A. californica (*Houttuynia californica*). A beautiful hardy aquatic with pungent, aromatic rootstocks, which are of great medicinal value and sold regularly in the drug markets of Mexico. They are also strung into necklaces—in the form of beads—and considered a specific against malaria and other diseases. The plant is of erect habit and closely allied to *Houttuynia*, with long-petioled radical leaves of a rounded to oblong shape. The white flowers are borne on a conical spadix, with a whorl of petaloid bracts below, which gives the inflorescence some resemblance to the flower of the anemone. California.

APONOGETON (*Aponogetonaceae*) 30 sp. The name *Aponogeton* was coined by the Italian botanist Pontedera in 1720, to designate a water plant (now called *Zannichellia*) found growing near Abano Bagni, celebrated in Roman times (as *Aponus* or *Fons Aponi*) for its hot springs.

A beautiful group of aquatics, mostly with emerging spikes of sweetly-scented flowers and flat floating leaves. The hardy sorts are particularly useful, for they are in character from April until October: indeed, it is not unusual to find stray flowers on *A. distachyum* right through the winter. The tubers can either be planted in the soil base of the pond, or set in small pots of loam and dropped into position. Propagation by seed or division of the tubers.

A. angustifolium, a rare South African species with narrow floating foliage and furcate spikes, is somewhat similar but considerably smaller than *A. distachyum*. The flowers are white with a rosy basal staining. *L.*

A. Bernerianum, see page 140.

A. Boehmii has submerged linear lanceolate leaves, and forked spikes of purplish flowers thrust above the water. East Africa. *G.*

A. crinifolium has slender, almost root-like foliage and bifid spikes of flowers. Africa; Australia. *G.*

A. crispum is sometimes grown as a greenhouse aquatic; it bears small white flowers 2 to 3 in. above water level, and submerged linear lanceolate leaves. Ceylon. *G.*

A. desertorum. Africa; Australia. *G.*

A. Dinteri has a roundish tuber which produces oblong floating leaves, somewhat curved at the base, and twin-spiked inflorescences of yellowish flowers. South-West Africa. *G.*

A. distachyum (Water Hawthorn; Cape Pondweed). A charming water plant quite hardy in this country, a prolific bloomer, and one of the few aquatics that can be grown in shade. It has a tuberous rootstock and broad strap-shaped leaves floating on the water surface, these being green, occasionally mottled with purplish-brown blotches. The flowers, packed tightly together on a forked spike, are snow-white with jet-black anthers and emit the delicate vanilla fragrance of the hawthorn—especially towards evening. They seed freely and in sheltered positions sometimes become a nuisance, but, if the old flower heads are regularly removed with a knife attached to a long stick (see page 308) the plant should be easily kept under control. The depth of water seems to be immaterial; we have seen it equally happy in 4 in. deep as in 2 ft., although shallow water is to be recommended when first planting. Occasionally, a pink or rose-hued form is found, but the colouring does not seem to be fixed, for the older flowers are generally white again.

The tubers would appear to have economic properties, for they are eaten by the South African native. Mr. Clarence Elliott, writing to *The Gardener's Chronicle* in 1936, mentioned that the inflorescence also was eaten, and described a delicious bredee made from the flowers cooked with fat mutton and onion. He also stated that it might be served as a vegetable and described the method as follows. 'Cook until tender in water, drain well and put into a saucepan with a piece of butter. Beat an egg or two together, add two tablespoonfuls of vinegar and pour the egg mixture into the cooked waterweed and stir until it thickens—but it must not boil.' This suggests a use for the unwanted flower heads! Africa; Australia. *H.*

A. distachyum var. *aldenhamensis* originated in the gardens of the late Hon. Vicary Gibbs and is a greatly improved form of the type. The flowers are very much larger and stouter and the foliage suffused with a bronze-purple flush. *H.*

A. distachyum var. *grandiflorum* is another white-flowered form larger than the type. *H.*

A. distachyum var. *Lagrangei* is a very rare yet beautiful variety with violet bracts and violet under-surfaces to the leaves. *H.*

A. distachyum var. *roseum* was listed by Henkel in 1908 as a rose-flowered form of the type: it may be still in cultivation, but

we have never seen it; possibly, like the varieties raised at the nurseries, it reverts in time to the type. *H.*

A. echinatum, with a single white spike and linear leaves, is mentioned by Roxburgh as growing in shallow water in India. *G.*

A. elongatum has slender, simple spikes of yellow flowers and oblong or lanceolate leaves 6 to 12 in. in length. These are contracted at the base and arise from a smooth, bulbous rootstock. Australia. *L.*

A. fenestrale, see page 140.

A. gracile is a dainty plant of little horticultural importance. It has small round tubers, slender, oblong lanceolate leaves on long petioles and 2 to 4 in. spikes of small white flowers. Transvaal. *L.*

A. Henckelianus, see page 141.

A. hereroensis, a small plant arising from a thickened base, produces narrowly linear leaves about 3 in. long by 1 in. broad; tapering at the base. The flowers are white, very delicate, with brown stigmas. Lower Guiana. *G.*

A. Heudelotii, a very beautiful species with densely packed twin spikes of creamy flowers and lanceolate leaves somewhat similar to *A. distachyum*. Africa; Australia. *L.*

A. Holubii has oblong, elliptical leaves $4\frac{1}{2}$ to 6 in. by 2 to 3 in. long and densely packed bifid spikes 3 to 4 in. in length.

A. Krauseanum. We have had this plant about four years and proved it to be one of the finest pond aquatics in cultivation; the tubers planted in shallow water (4 to 9 in.) in a sunny situation, showing a profusion of bloom throughout the summer months. The strap-shaped foliage is not such a dark green nor as substantial as that of *A. distachyum*, but the flower spikes are much daintier and stand several inches out of the water. They are of a uniform shade of creamy sulphur, sweetly scented and seed freely. Africa; Australia. *H.*

A. leptostachyum is a small greenhouse aquatic with white forked spikes of flowers and usually submerged, oblong lanceolate foliage. Africa; Australia. *G.*

A. leptostachyum var. *abyssinicum* (*Ouvirandra Hildebrandtii*) is a pretty little plant for 1 to 2 in. of water in a greenhouse tank, or it will succeed in shallow pans of loam and water. Twin spikes of dainty lilac flowers about $\frac{3}{4}$ in. in length emerge from the water

and small, strap-shaped leaves float on the surface. The plant is monocarpic and seeds freely. Abyssinia. *G.*

A. Loriae has lanceolate, membranous leaves on very short petioles, the margins waved and crested. The inflorescence consists of a single densely clothed spike. New Guinea. *G.*

A. microphyllum is described by Roxburgh as a blue-flowered form with inch-long leaves lying close to the ground. We know nothing of it. India. *G.*

A. natalense has elliptical membranous leaves on very long petioles, always entirely submerged, and a yellowish forked inflorescence. Africa; Australia. *G.*

A. natans (*A. monostachyum*) has oblong or lanceolate foliage, 3 to 4 in. long, and a bulbous rootstock thickly covered with the fibrous remains of leaf sheaths. The flower spike is simple, pink and 2 to 2½ in. in length. The tubers are eaten in India. Australia; India; China. *G.*

A. quadrangulare has submerged, shortly petioled leaves, linear lanceolate with rounded ends. The inflorescence is divided into four or six creamy-flowered spikes and is very fragrant. Madagascar. *G.*

A. Rehmannii bears oblong oval leaves, 1 to 1½ in. long, and densely packed twin spikes of flowers. Tropical Africa. *G.*

A. spathaceum possesses very narrow or elongated spoon-shaped leaves and forked spikes tightly packed with pale lilac flowers. Africa; Australia. *G* and *L.*

A. spathaceum var. *junceum*, a small-growing greenhouse aquatic for shallow water, has narrow rush-like foliage, and twin spikes of white flowers having blue anthers. Africa; Australia. *L.*

A. Stuhlmannii has oblong lanceolate leaves 4 to 5 in. long, on long petioles, and slender spikes of flowers. Tropical Africa. *G.*

A. ulvaceum, with small sulphur-white flowers standing above water level, is occasionally grown as a greenhouse aquatic. The submerged foliage is really beautiful, being crimped and waved at the edges so as to somewhat resemble a scolopendrium fern. Having had this plant only for a year or two we have not tested it with fish as an aquarium subject, but there seems little doubt it would make an attractive addition to tropical tanks. Madagascar. *G.*

A. undulatum (*Ouvirandra undulatum*) has the foliage always submerged, this being lanceolate and 5 to 6 in. long by 1 in. broad. The flowers are borne on a very lax spike. Malabar. *G.*

A. vallisnerioides has slender grassy foliage, very like that of *Vallisneria spiralis*, and spikes of flowers thrust well above water level. Tropical Africa. G.

BRASENIA (Cabombaceae) 1 sp. Water Shield or Target.

A monotypic genus widely distributed throughout all the continents but Europe. Not a showy plant, it is interesting and attractive for the pool edge but difficult to get established. Increase is effected by means of the seed or offsets.

B. Schreberi (*B. peltata*; *Hydropeltis purpurea*) has small, oval, entire floating leaves, the submerged parts being covered with a thick gelatinous matter. The flowers are about half an inch across and purple coloured. In its native haunts the plant often grows in 4 to 6 ft. of water or in slow streams. North America; Cuba; East and Tropical Asia; West Tropical Africa; Australia.

BUTOMOPSIS, see Tenagocharis.

BUTOMUS (Butomaceae) 1 sp. Name from *bous*, an ox, and *temno*, cut; the leaves are said to cut the mouths of cattle that crop it. Flowering Rush; Water Gladiole.

B. umbellatus. This elegant British aquatic is a useful subject for 2 to 6 in. of water, being easily grown and readily propagated by division. Growing 2 to 4 ft. high, it produces handsome umbels of rose-pink flowers which stand out conspicuously against sword-shaped leaves. The latter when young are a delightful bronze-purple shade, but with maturity assume a uniform green colour. The seeds and roots were once used medicinally as emollients, whilst the baked roots are eaten to-day as food in Northern Asia. North temperate regions. H.

CALDESIA (Alismataceae) 3 sp. By some authors included in *Alisma*. The name commemorates an Italian botanist, Luigi Caldese (1821-1884).

C. oligococca (*Alisma oligococcum*; *A. apetalum*) has a short rhizome; long-petioled, broadly-ovate to cordate leaves (3 to 5 in. long by 2 to 3 in. broad), and white panicles of flowers. Tropical Australia; India; Ceylon. G.

C. parnassifolia (*Alisma parnassifolium*; *Echinodorus parnassifolius*) is a widely distributed species growing about 12 in. high, with rounded foliage and small white flowers in July. Europe and North Africa. L.

C. parnassifolia var. *major* (*Alisma reniformis*) is larger in all its parts than the type. India; China; Australia. L.

The other species, *C. acanthocarpa*, comes from Australia (Queensland). All are propagated by seed or division.

CALLA (Araceae) 1 sp. From *kalos*, beauty. Bog Arum.

C. palustris, an attractive and useful little plant for the pond margin, where the long scrambling rootstocks may creep in and out the water at will. It bears many small, shiny, heart-shaped leaves one year, and two leaves and a small white arum-like flower the next. This is followed in autumn by a globular cluster of red berries. The plant is of interest as one of the few known to be fertilised by snails. Pond snails attracted by the rather offensive odour crawl up the stem, pollinating the flowers as they go. The rhizomes, although extremely acrid and caustic, are—according to Linnaeus—made into a kind of bread called Missebröed held in esteem in Lapland. It is made by drying and grinding the roots, afterwards boiling and macerating them to deprive them of their acrimony; the resultant flour being baked like any other farinaceous substance. Propagation by division of the rootstocks. East North America; Europe; Northern Asia. *H.*

CALTHA (Ranunculaceae) 20 sp. Name of uncertain origin; applied by Pliny to a many-petalled, strong-smelling plant, and by Virgil to one with yellow flowers, possibly *Calendula officinalis* Marsh Marigold; Kingcup; Water Cowslip. Calthas are also known by the following old English names: Water Dragon; Water or Horse-blob; May-blob; Meadow Gowan; Meadow Rout.

A genus of beautiful bog plants indispensable for the water garden. They bloom very freely year after year, frequently maturing a second crop of blossom in the autumn. Calthas succeed best in wet places near running water, although several will grow actually in the water and even do well as border plants. The flowers are usually cup-shaped with yellow sepals (there are no petals) and last well in the cut state. In country places the common Marsh Marigold, *C. palustris*, is sometimes known as Meadow Rout, and Withering gives a curious account of its medicinal properties. He says, 'It would appear that medicinal properties may be evolved in the gaseous exhalations of plants and flowers; for on a large quantity of the flowers of Meadow Routs being put into the bedroom of a girl who had been subject to fits, the fits ceased. An infusion of the flowers was afterwards successfully used in various kinds of fits both in adults and children.' The juice

of the petals (sepals) boiled with a little alum stains paper yellow, but is not permanent.

In North America the leaves are used as a spring vegetable (Cowslip Greens) and the flower buds are reputed to make an excellent substitute for capers. Propagation is naturally effected by seed or by division of the root in autumn or after flowering, also several of the species send out stolons. If seed is used, it must be sown whilst fresh and given a cool, moist place in partial shade.

C. Chelidonii, a rare species from high altitudes in the Canadian Rockies. Dwarf in habit, the glossy leaves, about $1\frac{1}{2}$ in. across, form a rosette with the flower stems rising above. They are snow-white with an abundance of golden stamens. Increase by seed or division and give a cool situation. North exposure suits the plant better than shade and the effect of transplanting often delays flowering for a year or two. *H.*

C. leptosepala, on a stout scape 8 to 12 in. high, carries solitary, white, narrow sepalled flowers. The dark green foliage is very similar to that of *C. palustris*. North America. *H.*

C. leptosepala var. *grandiflora*. A larger flowered form of the type, with silvery-white blooms in early summer. *H.*

C. natans (Floating Marsh Marigold) has slender, floating (or creeping in wet mud) stems, rooting at the nodes and 6 to 18 in. long. The leaves are almost round, 1 to 2 in. wide, and the single flowers white or pink. Arctic America; Northern Asia. *H.*

C. novae-zelandiae, a low-growing plant (1 to 6 in.) with radical-spreading leaves, 3 to 4 in. long, membranously sheathing the stem, and pale yellow, sweetly-scented flowers about an inch across. New Zealand. *L.*

C. palustris. A beautiful native plant which is almost the earliest to flower in the water garden, producing its rich golden flowers in wild profusion. Growing 9 to 15 in. high, the leaves are entire—often almost round—with dentate margins, whilst the flowers, borne on branched stems, resemble gigantic buttercups. North temperate and Arctic regions. *H.*

C. palustris var. *alba*, from the Himalayas, grows 9 in. high and is similar to the type but for white flowers. *H.*

C. palustris var. *biflora* has small, cordate or reniform leaves as in *C. palustris* and a slender scape holding two bluish-white flowers. North America. *H.*

C. palustris var. *flore pleno* is a very fine double-flowered form of the type. *H.*

C. palustris var. *nana plena*, a dwarf form, growing 9 in. high, with small round button heads of double flowers. *H.*

C. palustris var. *monstrosa plena* is very beautiful with larger flowers than the type, all very much doubled. It blooms about two weeks later than *C. palustris flore pleno* and the flowers are more fluffy. *H.*

C. palustris var. *Tyermanii*, a dwarf form with small single flowers. *H.*

C. polypetala, a beautiful plant of easy cultivation, growing 2 to 3 ft. high, with dark green leaves 10 to 12 in. across, and large golden-yellow flowers which are about 3 in. in diameter. The plant spreads rapidly by stolons, so must be kept under control; it should be planted in a few inches of water or near the waterside. Balkan peninsula; Asia Minor; Caucasus; Persia. *H.*

C. radicans, a rare British plant, now considered a variety of *C. palustris*, has a procumbent stem rooting at the nodes, dark green leaves and small yellow flowers, hardly an inch across. Wales and Scotland. *H.*

Other *Calthas* are:

C. andicola, Chile. *G.*

C. appendiculata, Straits of Magellan. *L.*

C. cornuta, Jugoslavia; Bulgaria. *H.*

C. De-Raneo, Chile. *G.*

C. dioneaefolia, Straits of Magellan. *L.*

C. holophylla, Chile. *G.*

C. introloba, Australia. *L.*

C. limbata, Chile. *G.*

C. longirostris, Jugoslavia. *H.*

C. orthorhyncha, Caucasus. *H.*

C. sagittata, Straits of Magellan. *L.*

C. scaposa, Himalayas. *H.*

COLOCASIA (Araceae) 8 sp. Old Greek and Latin name at first applied to *Nelumbo nucifera*; later transferred to *Colocasia esculenta*. Taro; Coco Root; Elephant Ear.

A genus of tuberous herbs grown chiefly for their foliage and succeeding best in shallow water or moist soil. All are of the easiest culture but rather rank-growing: the smaller species may be cultivated as pot plants and stood in a corner of the indoor pool. Colocasias furnish the taro or coco, an edible product made from the large, starchy rhizomes; which, when boiled, lose their poisonous nature and form valuable food. The Hawaiian



PONTEDERIA CORDATA, THE PICKEREL WEED



ORONTIUM AQUATICUM, THE GOLDEN CLUB



THE BEAUTIES OF ROCK AND WATER GARDENING ARE APPARENT
EVEN IN EARLY SPRING

A restful scene in Thorpe Hall Gardens



*In those vernal seasons of the year, when the air is calm and pleasant,
it were an injury and sullenness against Nature not to go out and see
her riches, and partake in her rejoicing with heaven and earth.*

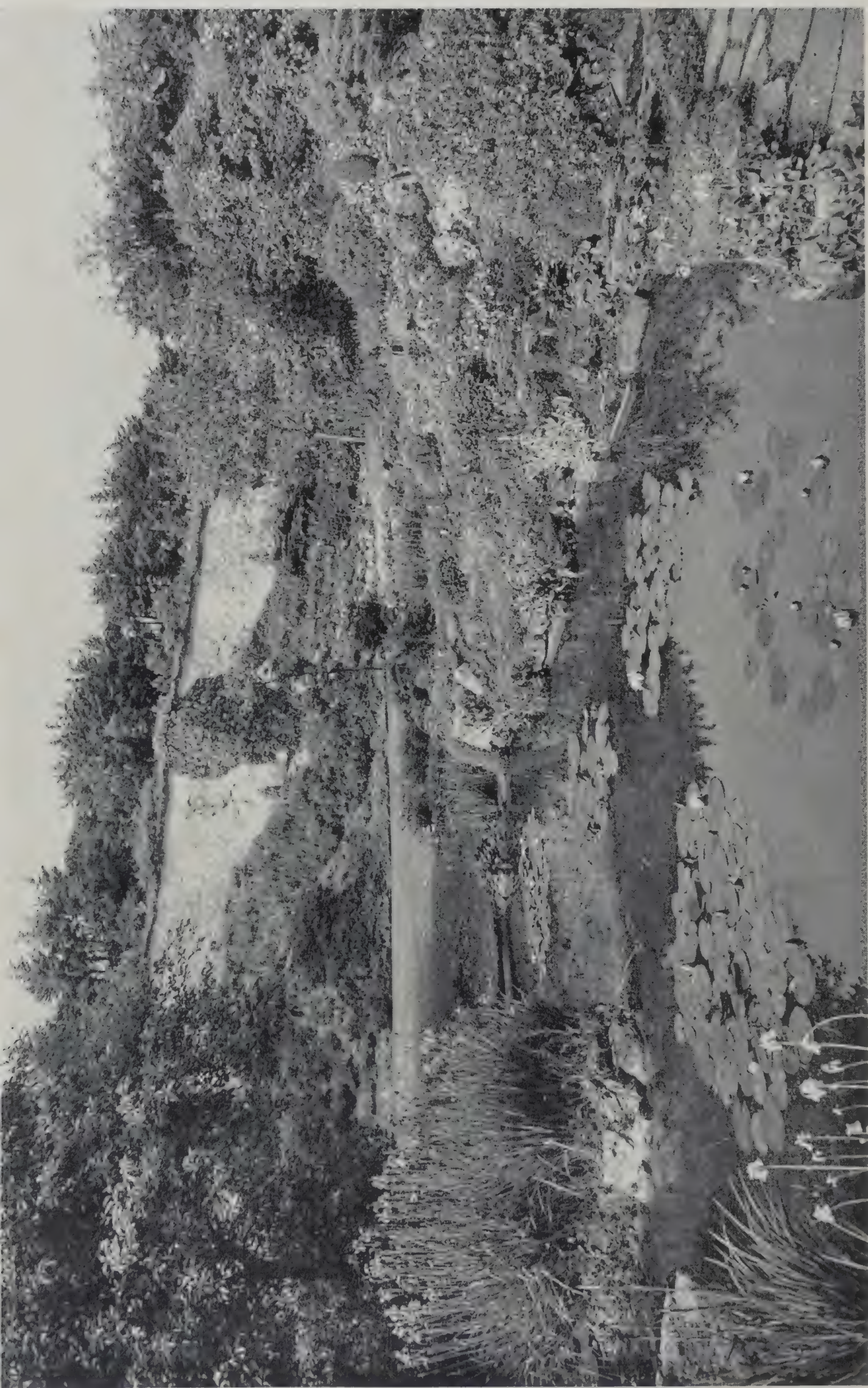
MILTON



HOUTTUYNIA CORDATA



SAURURUS CHINENSIS, THE LIZARD'S TAIL



CONSTRUCTED BY A MASTER HAND

poi is made from them also, whilst in Japan the tubers are much cultivated and eaten in the same way as we do potatoes. The young leaves and shoots of some kinds are also boiled and eaten. Propagation by division.

C. affinis is a small-growing species with thin membranous leaves (4 to 6 in. long), bright green with glaucous under-surfaces and a primrose-yellow spathe. Himalayas. *L.*

C. antiquorum has stoutly petioled, ovate to cordate leaves with broadly triangular bases (6 to 16 in. long) and a thick, stout, pale yellow spathe 8 to 18 in. high. Tropical Asia. *G.*

C. antiquorum var. *euchlora* has violet petioles and dark purplish-green leaves with violet edges. *G.*

C. antiquorum var. *Fontanesii* is a strong-growing variety which grows well in shallow water. It has violet petioles and dull green leaves with purplish edges and veining. *G.*

C. antiquorum var. *illustris* (Black Caladium) has the dull green foliage freely spotted with blackish-purple blotches. The flowers have an unpleasant odour. *G.*

C. esculenta (*Caladium esculentum*). Probably the most beautiful form, with large green leaves, 3 ft. or more long and nearly as wide. They are supposed to resemble in shape the ears of an African elephant. Tropical Asia, but now widely cultivated in warm countries. *G.*

COMARUM, see *Potentilla*.

COTULA (*Compositae*) 50 sp. From Greek, meaning small cup, in allusion to the clasping leaves forming a hollow.

C. coronopifolia (Brass Buttons), a pretty little plant freely distributed over the southern hemisphere and also found in some parts of Europe and North America, although probably only naturalised.

The stem, of a creeping nature, grows 6 to 12 in. high, bearing alternate, lanceolate, smooth, often toothed leaves and masses of small golden flowers, which resemble daisies with the outer florets removed. The foliage when crushed gives out an aromatic odour between lemon Verbena and Camphor. The plant is an annual but seeds freely and soon becomes colonised in the shallow water at the pond margin. Africa; Australia (Europe, alien). *H.*

DAMASONIUM (*Actinocarpus*) (*Alismataceae*) 4 sp. An old Greek name of uncertain origin, cited by classical authors as a synonym of *Alisma*. Starfruit.

The genus at first sight appears to be a compromise between *Alisma* and *Sagittaria*, for it shares the habits of both. The plant should be grown in wet mud or in shallow water at the pond-side.

D. Alisma (*Alisma Damasonium*; *D. stellatum*), one of our rarest British aquatics, only found in the south-east of England and certain Midland waters. The leaves are raised on long stalks and float on the surface of the water, whilst the flowers, which grow in whorls, are white, with a yellow spot at the base of each petal. The fruit is composed of six-pointed carpels, arranged in the form of a star. West and Southern Europe, incl. England, Mediterranean regions; Eastern Asia. *H.*

D. Alisma var. *compactum* is a dwarf form. *H.*

D. polyspermum grows only 6 or 7 in. high, with oblong lanceolate leaves on long stalks, and thin grassy submerged foliage. The flowers are white, borne several in a cluster, succeeded by curious spiked seed vessels. Spain; Algeria. *L.*

Other *Damasoniums* are:

D. minus, Australia, *D. californicum*, California.

DECODON (*Lythraceae*) 1 sp. Sometimes included in *Nesaea*. Name from *deka*, ten, and *odous*, tooth, referring to the ten-toothed calyx. Swamp Loose-strife; Water Willow.

D. verticillatus (*Nesaea verticillata*). A handsome shrubby perennial with very long wands 3 to 10 in. in length, which bend over and root from the tip when they reach water or mud. The leaves are lanceolate, 2 to 5 in. long, with whorls of purple lythrum-like flowers in their axils. The plant is perhaps most decorative in autumn when the foliage passes to brilliant crimson. Propagation is easily effected by cuttings. Eastern North America. *H.*

DIPHYLLEIA (*Berberidaceae*) 2 sp. From *di*, two, and *phullon*, a leaf; the leaves produced in twos. Umbrella Leaf.

D. cymosa. A beautiful plant with bright green umbrella-like leaves on very long petioles, and many-flowered umbels of white flowers, which are succeeded by blue berries with a bloom. Suitable for moist but not water-logged soil. Eastern North America. *H.*

DRACOCEPHALUM (*Labiatae*) 50 sp. From the Greek, dragon's head, alluding to the shape of the corolla.

D. palustre, a gay little plant for shallow water planting and one that does not become rampant. Growing 12 to 15 in. high,

an established specimen will produce five to six flower-spikes of bright rose 'snapdragon-like flowers'. The foliage is quite pretty, being narrowly lanceolate with slightly serrated margins. We are a little uncertain of the specific name of this plant, but it is an excellent aquatic and long known to the trade as *D. palustre*. Propagated from cuttings. *H.*

ECHINODORUS (Alismataceae) 23 sp. Name from the Greek *echinos*, hedgehog, and *dorus*, a leather bag or wallet, in allusion to the spiny fruit of some species.

A genus of waterside plants with the habit and general appearance of *Alisma*. Cultivation and methods of propagation are identical.

E. ranunculoides (*Alisma ranunculoides*), a British species with narrow leaves, tapering at either end, and terminal umbels of rosy-white flowers. South and West Europe incl. Britain; North Africa; Canaries. *H.*

E. rostratus (*Alisma cordifolium*) (Upright Bur-head) has very variable foliage, this being sometimes quite broad and ovate or on younger plants nearly lanceolate. One or more erect scapes carry several whorls of white or pinkish flowers in the summer. The plant is native to North America and the West Indies and grows about 1 ft. high. *L.*

E. tenellus is a delicate stoloniferous plant, 4 to 5 in. high, bearing lanceolate or linear-lanceolate leaves on long petioles. The white or rose-tinted, three-petalled flowers are carried on umbels. North and South America. *H.*

Other species are:

E. alpestris, Spain. *H.*

E. bracteatus, Panama. *G.*

E. brevipedicellatus, Brazil. *G.*

E. ellipticus, Trop. America.

G.

E. grandiflorus, S. America. *G.*

E. humilis, Trop. Africa. *G.*

E. intermedius, Brazil. *G.*

E. longipetalus, Brazil. *G.*

E. longistylis, Brazil. *G.*

E. macrophyllus, Trop. America. *G.*

E. Martii, Brazil. *G.*

E. nymphaeifolius, Cuba. *G.*

E. ovalis, Cuba. *G.*

E. paniculatus, America, Australia. *G.*

E. patagonicus, Patagonia. *G.*

E. punctatus, Brazil. *G.*

E. radicans, Central America. *G.*

E. Sellowianus, Brazil and Uruguay. *G.*

E. subalatus, Guiana and Brazil. *G.*

E. virgatus, Mexico. *G.*

EICHHORNIA (Piaropus) (Pontederiaceae) 6 sp. Named after J. A. F. Eichhorn, a Prussian Minister, born 1779.

A handsome and most interesting genus of tropical aquatics which includes the curious water hyacinth (see page 130). With one exception they are confined to South America and all possess bright showy flowers borne on spikes or panicles. Good soil is necessary so that the plants will derive some nourishment and full sunshine with plenty of space for development. Propagated by cutting off and planting the young growing tips or by separating the stolons from the parent plant.

E. azurea (Pontederia azurea). This beautiful plant is a most desirable acquisition for the tropical aquatic tank, although rather rampant, so it is necessary to prevent its encroachment on other things by occasionally cutting back the stems. If left undisturbed, a single plant reaches 5 to 6 ft. across in a season, creeping over the water surface until the whole is covered. The shining thick leathery leaves, borne on spongy (not inflated) petioles, are very variable in size and shape, whilst flowers are freely produced on stout, erect, hairy scapes. They are funnel-shaped and clear lavender-blue with the inner segments prettily fringed, the upper and larger segments being marked with a heart-shaped, yellow blotch outlined in white. A peculiarity of their structure is worth recording. The six petals or segments which constitute the perianth are united at the base and again at the top of the tube, but between these two points are three apertures (or windows as Seubert calls them in *Flora Brasiliensis*), the purpose of which is not quite clear. A possible explanation is that they provide a way of access for crawling insects, which otherwise would not enter to fertilise the flower. Tropical America. G.

E. cordifolia is not in general cultivation and probably only seen in Botanic Gardens. The smooth, green leaves are broadly cordate, about 4 in. long and 3 in. across, whilst the peduncle or flower stalk arises from the middle of the petiole and carries an elongated raceme of bluish-purple flowers. Cuba. G.

E. crassipes. See *E. speciosa*.

E. Martiana (*E. tricolor*; *E. paniculata*) was at one time freely cultivated in this country, but now is rarely seen even in the Botanic Gardens. It is a fine plant in bloom although not as attractive as *E. azurea*, which species it greatly resembles in growth and foliage. The flowers are borne in a compound spike or panicle,

and are about an inch in diameter, the lower petals being a rich purple and the three upper ones pale blue with a conspicuous lemon-yellow blotch in the centre of each. The leaves are smooth, heart-shaped, shining and carried on long petioles. S. America. *G.*

E. natans is the smallest of the genus and quite distinct in growth. It bears two kinds of foliage, the submerged being linear and 1 to 2 in. long, whilst small, ovate to ovate-orbicular leaves float flat on the surface. The flowers are solitary, small, blue and barely $\frac{1}{2}$ in. in length. Tropical Africa. *G.*

E. paradoxa (*E. Schultesiana*) is not, we believe, in cultivation, which is a pity, for it is most attractive. Leafless, it produces a short rhizome from which emanate numerous tufts of flower scapes; these being from 9 in. to a foot high, thick, spongy, hexagonous towards the apex with very sharp angles, and carrying umbels of two to five flowers. The upper petal is violet with two spots at the base, the lateral ones pale violet with a conspicuous rosy-purple line running down the centre of each, and the lower one white and very narrow. According to Seubert, seeds are very freely produced, which makes it all the more remarkable that such an attractive plant is almost unknown. Brazil. *G.*

E. speciosa. See page 131.

ELISMA. See page 150.

GRATIOLA (*Scrophulariaceae*) 25 sp. From *gratia*, grace of God, from its reputed healing properties.

A genus of little horticultural importance except for the two described below, which may be used for covering the muddy borders of ditches and natural pools. Propagation by division or seed.

G. aurea (Goldenpert; Golden Hedge hyssop). A North American annual of creeping or ascending habit with branching stems 4 to 12 in. high. The leaves are lanceolate, $\frac{1}{2}$ to 1 in. long, with bright golden, axillary mimulus-like flowers. *H.*

G. officinalis has serrated lanceolate foliage and bright blue axillary flowers. The leaves and roots are reputed to be of medicinal value and in overdoses become a violent poison. According to Haller, it renders by its presence many Swiss meadows useless as pastures. Europe. *H.*

HELMHOLTZIA (*Philydraceae*) 2 sp. Named after the German philosopher and scientist, Hermann Ludwig Ferdinand von Helmholtz (1821-1894).

A genus of aquatics for 5 to 6 in. of water, rarely cultivated, and reproduced from seed.

H. acorifolia grows 2 to 3 ft. high with long leaves and woolly panicles of white flowers (each about $\frac{3}{4}$ in. long). Australia. *L.*

H. glaberrima is similar to preceding but smooth throughout. Polynesia. *G.*

HERPESTIS (Scrophulariaceae) (*Bramia*; *Septilia*; *Monniera*) 65 sp. Name from the Greek *herpestes*, anything that creeps, alluding to the habit of the plant. Hedge Hyssop.

A genus from the warm and tropical parts of the world, many of them weedy but a few worth cultivating for their services in covering the bare surface of wet soil in which taller or erect-growing plants are situated. They like a rich loamy compost and are propagated by seed or division.

H. acuminata (*H. nigrescens*) grows 1 to 2 ft. high and is very branched and leafy. The foliage is oblong or oblong-lanceolate with serrated edges whilst the axillary flowers are purple. North America. *H.*

H. amplexicaulis (*Septilia caroliniana*) is a handsome fleshy plant growing 6 to 18 in. high, with oval sessile leaves tightly clasping the stem. The plant is softly pubescent throughout and carries most attractive rich blue flowers. Although without value as an oxygenator, the plant is often used as an aquarium subject. North America. *L.*

H. Monniera. A small but dense-growing plant of prostrate and perennial habit. The solitary mimulus-like flowers, arranged in the axils of round, fleshy leaves, are pale blue and about $\frac{1}{2}$ in. in length. Lindley states that the Indian natives use the expressed juice of this plant, mixed with petroleum, to rub on parts affected with rheumatic pains. Cosmopolitan. *L.*

H. rotundifolia is of creeping and spreading habit, carrying pairs of almost round, stalkless leaves clasping a hirsute stem. The flowers are small, whitish or blue and borne several together in the leaf axils. Muddy shores, North America. *L.*

HETERANTHERA (Pontederiaceae) 11 sp. From *heteros*, variable, and *anther*, an anther; the anthers are variable.

A genus of small ornamental aquatics: the hardy sorts suitable for the pond margin and the others for pond culture or the aquarium. The leaves are frequently of two types—linear submerged, and orbicular floating. Propagation by division.

H. callaefolia has a white spathe-like inflorescence, 4 in. long, thickly crowded with small flowers, and broadly cordate long petioled leaves. The plant grows about 1 ft. high with a creeping stem, rooting in the lower part. Tropical Africa. G.

H. graminea. See page 153.

H. Kotschyana, collected by Rehmann in N. Transvaal, grows 5 to 12 in. high and is herbaceous and glabrous, the lower part of the stem rooting at the nodes. Cordate leaves, 1 to 3 in. long by $\frac{1}{2}$ to 2 in. broad, are carried on petioles 2 to 8 in. in length. The flower spike (2 to 4 in.) bears several sessile, whitish flowers. Australia; East Africa. G.

H. limosa (*Pontederia limosa*; *Leptanthus ovalis*) (Smaller Mud Plantain) is a North American plant with short erect radical leaves which in deep water become elongated and of a swimming nature. In the shallows it grows in clumps, producing ovate or cordate foliage standing 6 to 15 in. above water level and tubular spathes of blue or white flowers. Cuba; Brazil. G.

H. peduncularis is of small creeping habit and roots freely at the nodes. It is similar but differs from *H. reniformis* by reason of the narrower leaf-blades and blue perianth. Tropical America. G.

H. Potamogeton carries elongated oval leaves on long petioles. The flower spike is short, bearing a few distant whitish blooms. We have not seen this plant, but it is supposed to resemble a *Potamogeton* in appearance. Tropical Africa. G.

H. reniformis (Mud Plantain) can be grown in a shallow indoor tank, where it quickly scrambles across the surface and trails over the edges. The long branching stems bear smooth kidney-shaped leaves (about 1 in. across) and occasional bunches of washy blue flowers. It is a plant of little beauty and inclined to become weedy. Propagated by breaking off slips, which quickly root at the nodes. South and Tropical America. G.

H. Seubertiana (*Eichhornia graminea*), a rare blue-flowered species from the Brazilian tropics, not in cultivation, has elongated lanceolate leaves. G.

H. spicata bears short, erect basal leaves and is of a creeping nature. The leaves are cordate, long-petioled, and the spikes carry two or three violet-blue flowers. Cuba. G.

HOULTUYNIA (Saururaceae) 1 sp. Named after Martin Houttuyn (1774-1783), a Dutch naturalist.

H. cordata (*Gymnotheca chinensis*; *Polypara cochinchensis*). This plant having proved hardy in Britain is a decided acquisition for the bog and pond garden, and of interest in that it seeds parthenogenetically. The bluish-green cordate leaves, the bright red stems, and the four snow-white bracts form a graceful background to a terminal spike of small white flowers. The creeping rootstock can be planted in heavy loam covered with 2 to 4 in. of water, or simply grown in wet soil. It grows from 6 to 24 in. high. Himalayas to China and Japan. *H.*

HYDROCERA (*Tytonia*) (*Balsaminaceae*) 1 sp. From *hudor*, water, and *keras*, a horn. Water Balsam.

A monotypic genus, the species being a delightful greenhouse aquatic, requiring to be grown in rich loamy soil in large pans or tubs of water. The plant is monocarpic but may be increased by seeds sown in spring.

H. angustifolia (*H. triflora*; *Tytonia natans*) has very large irregular flowers beautifully variegated in red, white and yellow, the lower petals being much larger than the others and standing well out. Narrow alternate leaves float on the surface; the plant blooms from July to September. Tropical Asia. *G.*

HYDROCLEYS (*Alismataceae*) 3 sp. From Greek words *hudor* and *kleis*, meaning Water Key.

H. Commersonii (*Limnanthemum Humboldtianum*; *Limnocharis Humboldtii*; *H. nymphoides*; *Stratiotes nymphoides*; *Vespuccia Humboldtii*; *H. Humboldtii*; *Limnocharis Commersoni*) (Water Poppy). A beautiful perennial aquatic with thick, oval, floating, deep green leaves and handsome three-petalled flowers. These are light yellow, 2 to 2½ in. across, and stand well above the water but only last for a day. For best results the plant needs rich loam and 6 to 9 in. depth of water: it is not generally reckoned hardy, although we have often wintered it outdoors in mild winters at Enfield. The plant is very free-flowering and most prolific. Propagated by cuttings. Brazil. *L.*

H. Martii, a very dainty species with delicate rounded leaves borne on slender flowering petioles. The flowers are small, white, and stand just above water level. Brazil. *G.*

H. parviflora has elliptical leaf-blades on long petioles. The inflorescence is terminal, two to three-flowered, with pale yellow blooms. Brazil. *G.*

HYDROCOTYLE (*Umbelliferae*) 75 sp. From *hudor*, water, and

cotyle, a cavity, referring to the habitat and the leaves being hollowed out like cups. Pennywort.

H. vulgaris. A weedy and uninteresting plant with round, crenate foliage and inconspicuous white flowers. Propagated by division. Europe. *H.*

HYDROLEA (Hydrophyllaceae) 20 sp. From *hudor*, water, and *elaia*, oil, alluding to the situation and oily appearance of the plant.

Annual or perennial sub-shrubby plants rarely cultivated, and sometimes included under Nama. They are handsome when in flower and often armed with spines. Cuttings will root readily in sand under glass; or propagation may be effected by seed.

H. spinosa is an erect-growing, free-flowering water plant 1 to 2 ft. in height, producing corymbose panicles of rich, clear blue flowers. The lanceolate leaves look as if smeared with oil and often have sharp thorns in the axils. It is a pretty plant and easily grown in a few inches of water. South America. *G.*

H. zeylanica has short petioled, bright green lanceolate leaves and axillary racemes of flowers—pale blue with a white spot in the centre. The leaves, beaten into a pulp and applied as a poultice, are considered efficacious in India as a remedy for ulcers. Tropical regions. *G.*

HYMENOCALLIS (Amaryllidaceae) 32 sp. Greek, beautiful membrane, alluding to the webbed filaments.

H. crassifolia (*H. occidentalis*) (Spider Lily), found growing along streams and creeks in sandy marsh ground in Kentucky; the plant has not proved hardy in Britain. It forms a large bulb with thick strap-shaped foliage. The flowers are white, three to six in an umbel, deliciously fragrant and bloom in the late summer. Offsets from the bulb are plentiful and seed is also obtained. *G.*

HYPERICUM (Guttiferae) 300 sp. (one aquatic). Name from the Greek, original name of the plant. St. John's Wort.

H. elodes (Marsh Hypericum). A useful plant for hiding the junction between pool and land: bearing creeping, prostrate stems—6 to 12 in. long—often reddish, and small, opposite, rounded perfoliate leaves, which, being thickly covered with soft silky hairs, present a glaucous appearance and are downy to the touch. A few pale yellow flowers appear during the late summer. Propagation by division. Europe, incl. Britain. *H.*

IRIS. See page 262.

JUNCUS (Juncaceae) 225 sp. A classical name, probably from *juncere*, to join, from their use in wickerwork. Rushes.

A large and extensive genus, found chiefly in cold and wet places (rarely in the tropics), which should only be cautiously introduced to the water garden. The majority are of little horticultural value, being weedy and troublesome to eradicate when once established; but the few here described are grown in pools for their curious effects. Except for *J. effusus* var. *spiralis* (which is naturally slow-growing) the roots should be confined to a definite area or periodically thinned out.

An ancient family (fossil species are known) they have long been employed for economic purposes. In India and China light hats are made from the pith of certain species, and—as in medieval England—candle wicks and rush tapers. The English stage was strewn with rushes in Shakespeare's time and the old Globe Theatre roofed with them; in fact, it was through these catching fire that the theatre was burned down. The strewing of rushes before processions was common to many countries. Thus, in Shakespeare's *Henry V* we find the grooms crying out 'More rushes, more rushes!' when heralding the approach of the coronation procession.

During Wolsey's time, before the days of carpets, the cut rushes were strewn on the ground as a floor covering, and owing to the distance from London at which they grew, and the cost of transporting them thither, one of the charges of extravagance laid against the worthy cardinal was 'that he caused his floors to be strewn with rushes too frequently'. A little later we find the learned Erasmus indicting this practice as an unhealthy one and ascribing to its habit the prevalent diseases and infections of the time; especially as the custom then was to throw bits from the table to the dogs lying about, so that these scraps of meat, beer swillings and other unwholesome substances lay about the floor and rotted. Owing to the cost of renewing the rushes—especially if the houses were at any distance from the fens in which they grew—they were not changed very often (or only the top ones), so that the lower layer became a foul breeding ground for germs. Having regard to these circumstances, Erasmus' rebuke seems a just one.

Old parish records often show accounts for rushes with which to strew the church floors, and the earliest of all betrothal rings

were made from *J. communis*. As far back as 1217, Richard, Bishop of Salisbury, had to pronounce an edict against the use of *annulum de junco* owing to its misuse for mock marriages; Shakespeare mentions these rush rings in *Two Noble Kinsmen*. *J. acutus* is reputed to be the thorn used for Christ's crown, and certainly the Crown of Thorns preserved at St. Denis in Paris is composed of rushes. Propagation by division.

J. effusus, the common rush used for mats and seating, growing 1 to 4 ft. high, with dark green stems and brown inflorescence. Worldwide distribution. *H.*

J. effusus var. *aurea-striatus* grows about 2½ ft.; the thick, dark green rush stems longitudinally striped with yellow. *H.*

J. effusus var. *spiralis*, an attractive variety growing 18 in. high, with the stems twisted throughout in a curious corkscrew manner. *H.*

J. follicularis, very narrow, dark green foliage 12 in. high. *H.*

J. follicularis var. *variegatus* is quite a pretty little plant, with tufts of dark green foliage banded in white. 2 ft. *L.*

J. bufonius (Toad Rush), a useful plant for naturalising as game cover in large water stretches. Seldom exceeding 8 in. in height, the plant forms dense clumps thickly clothed with reddish inflorescence. It is an annual, but seeds itself naturally if left undisturbed. Worldwide distribution. *H.*

J. Gerardi (Black-grass) grows 8 to 24 in. high with creeping rootstocks, long flat blades and abundant dark brown inflorescence, which turns straw-coloured with age. North temperate regions. *H.*

J. glaucus (Hard Rush) has slender, furrowed stems—glaucous green and 2 to 2½ ft. high. Universal. *H.*

J. nodosus (Knotted Rush). Erect stems 6 to 20 in. high, arising from a thickened rootstock, carrying several round, spiky heads of reddish-brown flowers. North America. *H.*

J. scirpoides (*J. polycephalus*) (Many-headed Rush), so called because of the abundance of perfectly round heads of inflorescence borne on compound flower spikes. North America. *H.*

JUSSIEUA (Onagraceae) 50 sp. Named after Bernard de Jussieu (1699-1777), who laid the foundations of the modern natural system of the vegetable kingdom. Primrose Willow.

Bog and water-loving herbs and shrubs with white or yellow primrose-like flowers and usually serrated, narrow leaves.

Aerenchyma tissue frequently develops on the lower part of the stem when the plant is growing in water. The flowers of *Jussieua pilosa* yield a yellow dye.

The majority, not being hardy in this country, need to be wintered indoors; they are readily propagated by means of seed or cuttings.

J. grandiflora very much resembles *J. repens* but is of more erect habit, forming a bushy plant about 2 ft. high. Peru; Carolina. *H.*

J. longifolia is of erect growth, with red stems some 4 ft. high, sparsely clad with narrow lanceolate leaves and soft yellow flowers. Another plant known as *J. longifolia*, and freely cultivated in the United States, does not fit the original description of this species. Brazil. *L.*

J. peruviana grows 1 to 4 ft. high, is of branched shrubby habit and has large golden flowers. Tropical America. *G.*

J. repens (*J. diffusa*) (Floating *Jussieua*) needs to be kept under control, but is a pretty little plant, hardy in Britain, with creeping or floating stems, 1 to 3 ft. long. It blooms freely, the inch-wide golden flowers standing above the water and arising from the axils of small, olive-green shining leaves. Ponds, Tropical America and Asia, also North America. *H.*

J. Sprengeri, a beautiful evergreen species, forms a bushy plant 5 to 6 ft. high; thickly clothed with oval woolly leaves and very large canary-yellow flowers. It makes an excellent plant for tub-culture and is readily reproduced by means of cuttings. South America. *L.*

J. suffruticosa grows to a compact bush 2 to 3 ft. high, with reddish stems and long lanceolate leaves—3 to 4 in. in length. Small yellow flowers are borne in the leaf axils. South America. *L.*

LIMNANTHEMUM (Gentianaceae) 20 sp. From *limne*, a swamp, pool or lake, and *anthemon*, a pool flower.

This genus gives us some pretty little aquatics, with floating leaves and a profusion of small flowers. They need, however, to be kept within bounds, especially *L. Nymphoides*, so should either have the roots confined in boxes or be thinned out occasionally. Propagation by cuttings or from the stolons.

L. indicum (Water Snowflake) is a really charming little plant. Small heart-shaped leaves float on the surface, and from the junction between leaf and leaf-stalk emanate clusters of dainty white

flowers with yellow centres. The petals are completely covered with little white, hairy glands, which give them a fringed appearance. The plant grows well in a shallow tank, pan or tub in the greenhouse. Florida. G.

L. lacunosum (Floating Heart). See page 132.

L. Nymphoides (*L. peltatum*; *Nymphoides peltatum*; *Villarsia Nymphoides*) (Water Fringe) is a native plant, hardy in 6 to 18 in. of water. The foliage, heart-shaped and mottled, is about 2 in. across and lies flat on the surface, whilst golden-yellow flowers stand 2 to 3 in. above the water. They resemble very fringed Iceland poppies. The plant is a good one to naturalise. The stems, being intensely bitter, are mentioned by Lindley as being of a tonic and febrifugal nature. Europe, incl. Britain; North America. H.

L. Nymphoides var. *Bennettii* resembles the type, but has rich green foliage, free from blemishes or discoloration. H.

L. trachyspermum. See page 133.

LIMNOCHARIS (Alismataceae) 3 sp. From Greek *limne*, a marsh, and *charis*, ornament, referring to the marsh habitat.

Greenhouse aquatics of little beauty.

L. flava (*L. emarginata*; *L. Plumieri*; *Alisma flavum*). An erect-growing aquatic, 1 to 2 ft. high, of stoloniferous habit, with ovate or cordate leaves: these being very light of colour and 4 to 6 in. long. The flowers are pale yellow bordered with white, from $\frac{1}{2}$ and $\frac{3}{4}$ in. in diameter, and borne in clusters of six or twelve. The plant should be grown in shallow water; it is inclined to make too much leaf in proportion to the flower. Propagated by seeds and division. G.

L. flava var. *indica* is a robust East Asiatic variety, with almost orbicular leaves, 6 in. across. G.

L. flava var. *minor* (*L. Laforestii*) is a low-growing variety with small, transparent, green underwater leaves and oval pale green foliage borne 3 in. above water level. The flowers are yellow. G.

L. mattogrossensis has erect, rounded, lanceolate leaves borne on long petioles and about three yellowish flowers on a long scape. It is of little beauty. Brazil. G.

LIMNOPHYTON (Alismataceae) 2 sp. *Limne*, marsh, and *phyton*, plant.

L. obtusifolium, an erect, succulent marsh plant with the

characters of *Alisma* except that the flowers are polygamous. The leaves, 6 to 12 by 4 to 8 in., are sagittate or triangular and the scape grows 2 to 4 ft. high, carrying many white blooms. Propagated by division or by seed. Asia; Tropical Africa. *G.*

The other species is *L. angolense* from West Africa.

LOBELIA (Campanulaceae) 220 sp. Named after Matthias de l'Obel. See also page 158.

L. paludosa (Swamp Lobelia). A perennial aquatic, growing 1 to 4 ft. high, with flat, oblong leaves and attractive spikes of pale blue flowers. It blooms from May to July and is found in North American pools. Propagated by division or cuttings.

LUDWIGIA (Ludvigia) (Onagraceae) 30 sp. Named after C. G. Ludwig (1709-1773), botanist and author at Leipzig.

A genus of creeping, aquatic or semi-aquatic plants often planted in the wet soil at the pond margin to disguise the concrete edges, or used in the aquarium for their decorative effects. See page 158. Propagated by seed or cuttings.

L. alata grows 1 to 3 ft. high with simple or branched stems. The leaves are alternate, linear lanceolate to linear, with greenish-white axillary flowers of a bell-shape. It is rarely cultivated as an aquarium subject, being too long. North America. *H.*

L. alternifolia (Seed-box; Rattle-box). An interesting erect shrub 2 to 3½ ft. high—not unlike an *Epilobium*—carrying alternate, lanceolate leaves, 2 to 4 in. long. The four-petalled yellow flowers are solitary, axillary and large for the genus. Bogs and wet woods, North America. *H.*

L. Curtissii, a coarse species with erect stems, often spongy below, and narrow spoon-shaped leaves, is occasionally grown in warm-water aquariums. Ponds, Florida. *G.*

L. linearis, growing 1 to 2 ft. high, has the lower part of the stem spongy with aerenchyma tissue. The leaves are alternate, sessile and narrowly linear, with inconspicuous axillary flowers. Swamps, North America. *H.*

L. microcarpa, a slender decumbent species, bearing small roundish foliage, reddish-bronze in the young state, changing to green with age. It may be grown in warm or cold aquariums but is not hardy. Tropical America. *G.*

L. Mulertii, introduced from South America about fifty years ago, is the species most widely used for aquarium work. The leaves are a beautiful bronzy-green above, tinted with crimson-

purple below; they are oblong-lanceolate. The flowers are small, yellow and axillary. South America. *G.*

L. palustris (*Isnardia palustris*) (Marsh Isnardia; Water Purslane) is the only British species and found at Buxted in Sussex and Brockenhurst in Hampshire. The stem is procumbent or floating, from 2 to 12 in. in length, generally branched and rooting at the lower nodes; with the leaves opposite, shortly stalked, oval in shape and very smooth and shining. The axillary flowers are inconspicuous and apetalous in the European form, although Torrey and Grey in *Flora of North America* speak of them having reddish petals. Under cultivation the plant becomes larger and much finer in every respect; it is frequently used for aquarium work. *H.*

LYCOPUS (*Labiatae*) 10 sp. Name from Greek, *lykos*, a wolf, and *pous*, a foot, from a fancied resemblance in the leaves to a wolf's foot. Water Horehound; Gipsywort.

L. europaeus, a weedy native plant with erect stems 9 to 12 in. high, deeply cut lanceolate leaves and axillary whorls of lilac flowers. The juice of the plant yields a black dye and is sometimes used to stain wool, silk and linen. It is called Gipsywort according to the old herbalists because 'those strolling cheats called gypsies do dye themselves of a blackish hue with the juices of this plant, the better to pass for Africans by their tanned looks and swarthy hides, to bubble the credulous and ignorant by the practice of magic and fortune-telling, they being, indeed, a suck of all nations living by rapine, pilching, pilfering and imposture'. Extremely narcotic, the plant has the reputation of being a powerful astringent to restrain internal haemorrhage. We remember once reading a newspaper account of the deaths of two children caused by eating the plant. Propagated by seed and division. Europe, incl. Britain; Asia. *H.*

MARSILEA (*Marsileaceae*) 68 sp. Named after Giovanni Marsigli (died 1804), an Italian botanist. Nardoo Plant.

Aquatic flowerless plants related to the ferns, with four-lobed leaves, resembling those of four-leaved clover. They 'sleep' at night like *Oxalis* and either float flat on the water or, in marshy grounds, stand erect. Chiefly native to Australia, they are rarely hardy in this country and of little value except as aquarium subjects or to the botanist who may care to study their curious methods of fructification. The Nardoo Plants of Australia,

Marsileas, occupy vast stretches of inundated land in that continent. During the dry seasons the seed cases strew the ground like grains of wheat and form a poor sort of food for the aborigine. For a while they constituted the only food of the survivors of the ill-fated Burke and Wills expedition. Propagated by sowing the spores or by division.

M. Drummondii for best results should be kept in fairly deep water, when the petioles will reach a length of 18 in. and form a very attractive plant. The stalks and leaves are covered with a silky down. Central and South Australia. G.

M. quadrifolia grows 3 to 5 in. high—or taller in water—with bright green leaves. In sheltered positions the plant is hardy and makes an attractive cover at the mud margin of ponds. Central Europe to Japan and North India.

The following species (many of them in cultivation), differing only in minute or botanical details, are difficult to describe without going into technicalities of little horticultural interest. We accordingly give just their names and habitat. For further information the reader is referred to Baker's *Handbook of the Fern Allies*.

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|--|--|
| <i>M. aegyptiaca</i> , Egypt. G. | <i>M. Berteroi</i> , St. Domingo. G. |
| <i>M. ancylopoda</i> , Ecuador. G. | <i>M. biloba</i> , Cape Colony. G. |
| <i>M. angustifolia</i> , North Australia. G. | <i>M. Brownii</i> , New South Wales. G. |
| <i>M. Burchellii</i> , Cape Colony. G. | <i>M. minuta</i> , India. G. |
| <i>M. capensis</i> , Cape Colony. G. | <i>M. muscoides</i> , Senegal. G. |
| <i>M. concinna</i> , Paraguay. G. | <i>M. mutica</i> , New Caledonia. G. |
| <i>M. condensata</i> , India. G. | <i>M. nubica</i> , Kordofan. G. |
| <i>M. coromandelica</i> , India. G. | <i>M. polycarpa</i> , Trop. America. G. |
| <i>M. crenulata</i> , Mauritius. G. | <i>M. pubescens</i> , S. France, Italy, Morocco. L. |
| <i>M. deflexa</i> , Brazil. G. | <i>M. quadrata</i> , Borneo. G. |
| <i>M. diffusa</i> , Algeria, Tropical Africa. G. | <i>M. senegalensis</i> , Senegal. G. |
| <i>M. distorta</i> , India. G. | <i>M. strigosa</i> , West Siberia, S. E. European Russia. H. |
| <i>M. Ernesti</i> , Caracas. G. | <i>M. tenuifolia</i> , Texas. G. |
| <i>M. fimbriata</i> , Guiana. G. | <i>M. rotundata</i> , Angola. G. |
| <i>M. gibba</i> , Central Africa. G. | <i>M. subterranea</i> , Senegal. G. |
| <i>M. gymocarpa</i> , Senegal. G. | <i>M. trichopoda</i> , Senegal. G. |
| <i>M. hirsuta</i> , North Australia. G. | |



MENYANTHES TRIFOLIATA, THE BOG BEAN



HYDROCLEYS COMMERSIONII, THE WATER POPPY

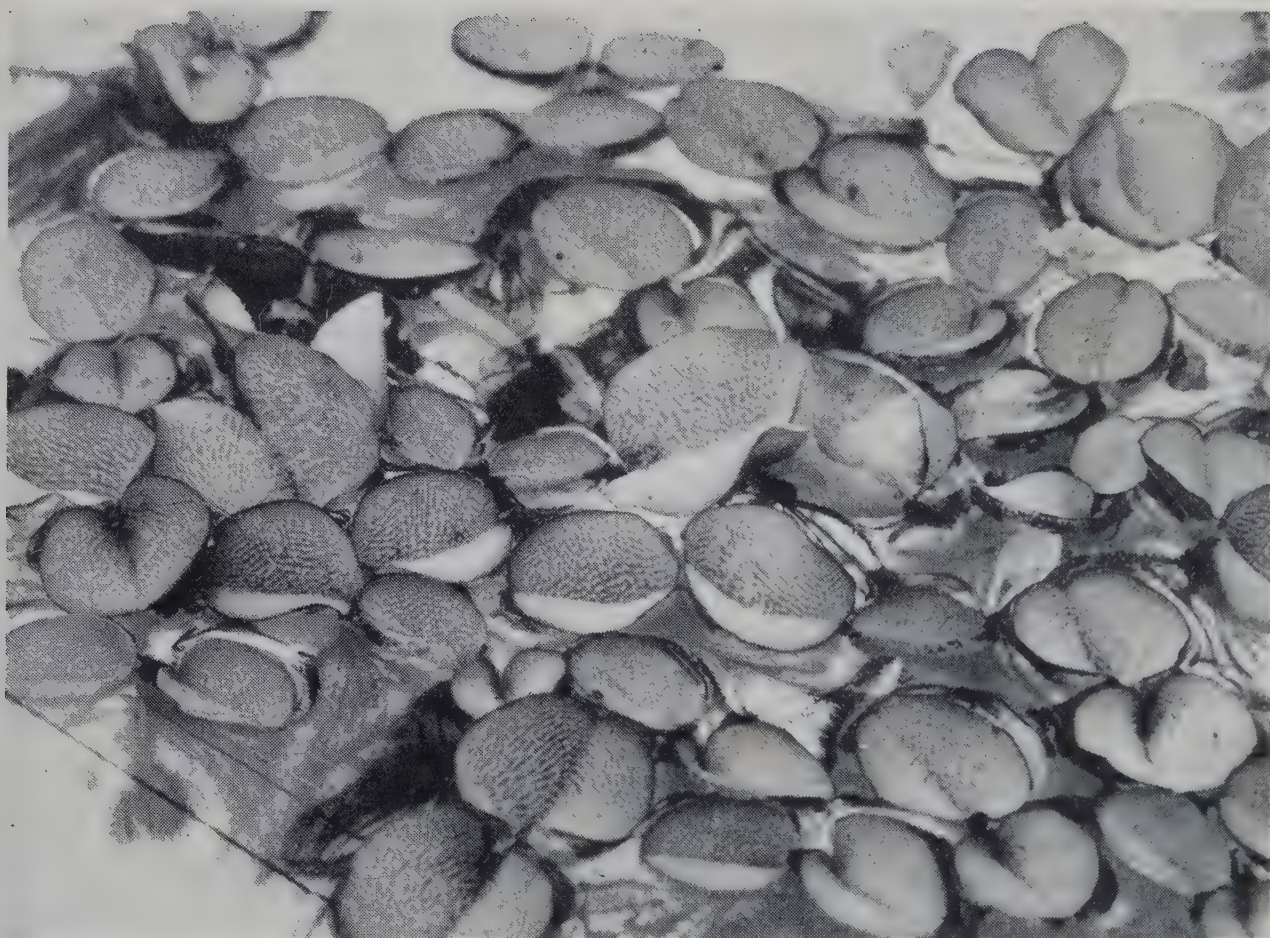


Lovlieness

*Needs not the foreign aid of ornament,
But is when unadorn'd, all the more*



*Where rivulets dance their wayward round,
A little streamlet flows*



SALVINIA AURICULATA



TRAPA NATANS, THE WATER CHESTNUT



EICHHORNEA SPECIOSA, THE WATER HYACINTH



CERATOPTERIS THALICTROIDES, THE WATER FERN

- | | |
|--|---|
| <i>M. macrocarpa</i> , Cape Colony,
Natal. G. | <i>M. vestita</i> , Tropical America.
G. |
| <i>M. macropus</i> , Texas. G. | <i>M. villosa</i> , Sandwich Islands.
G. |
| <i>M. mexicana</i> , Mexico. G. | |

MAYACA (Mayacaceae) 9 sp. Aboriginal name of the plant in Guiana.

A genus of prostrate aquatics revelling in shallow water or swamp conditions; they make excellent submerged aquatics, especially for tropical aquaria. Propagation by division.

M. Aubletii has tufted stems 3 to 15 in. long densely clothed with translucent, needle-like leaves. Solitary, white, star-like flowers are borne near the ends of every branch. North America. G.

M. fluvialis is similar to preceding, but considerably larger. Tropical and West America; Guiana. G.

M. Sellowiana grows 6 to 9 in., the light green mossy foliage spangled with rosy flowers. Brazil. G.

M. Vandellii also has rose flowers. Brazil. G.

Other species are:

- | | |
|----------------------------------|---------------------------------|
| <i>M. Endlicheri</i> , Peru. G. | <i>M. longipes</i> , Brazil. G. |
| <i>M. Kunthii</i> , Brazil. G. | <i>M. Wrightii</i> , Cuba. G. |
| <i>M. lagoensis</i> , Brazil. G. | |

MENTHA (Labiatae) 25 sp. Name, the Latin name of Mint. Strong-scented herbs grown chiefly for their essential oils and occasionally used as garden plants. A few are suitable for the aquarium or water garden and are increased by division or cuttings.

M. aquatica (Water Mint; Fish Mint). A common native growing 1 to 4 ft. high, with egg-shaped serrated leaves and whorls of lilac flowers, which towards the summit of the stem are crowded into heads. The plant is hairy throughout and strongly scented. Europe, incl. Britain; Asia; North Africa. H.

M. canadensis grows 6 to 24 in. high, with lanceolate leaves 2 to 3 in. long and whorls of light purple flowers. In America it is sometimes used as a substitute for peppermint. China; North America; New Mexico. H.

M. sylvestris grows 1 to 2 ft. high with tapering egg-shaped leaves, very white beneath, and slender spikes of lilac flowers. Europe, incl. Britain. H.

MENYANTHES (Gentianaceae) 2 sp. Apparently from *Menanthos* (Moon-flower); used by Theophrastus for a water-plant growing in the lake of Orchomenos.

M. cristii-galli (Nephrophyllidium) (Cock's Comb). A large species with reniform leaves 2 to 4 in. wide, borne on slender petioles 1 to 2 ft. in length, and simple or forked cymes of white fringed flowers. Marshy ground, North America to Alaska. *H.*

M. trifoliata (Buck-bean; Bog-bean; Marsh Trefoil). One of our prettiest native aquatics and a pleasing subject for the margins of a concrete pond. The plant has a horizontal, rhizomatous rootstock and delights to scramble from the moist soil at the pool edge into the water. The olive-green foliage is very smooth and borne in trefoils, which gives it some resemblance to that of the bean, whilst the flowers, borne in compound clusters, are pure white within and pink outside. The redness of the stamens forms a vivid contrast to the fringed petals. Propagation is easily effected by division of the rootstock into 12 in. lengths, each complete with a growing tip, and pushing these into the soft mud.

The plant has great tonic values, an infusion of the root, although extremely bitter, being of value and often recommended in fevers, gout and other complaints. In Sweden it is employed in the brewing of a bitter kind of beer, two ounces of leaves being used as the equivalent of one pound of hops. Linnaeus informs us in his *Flora Medica* that in times of scarcity flocks will subsist upon the plant, notwithstanding its bitterness, whilst Dr. Tancred Robinson asserts that sheep which have acquired a tabid condition quickly recover after feeding on it. The Laplanders introduce the powdered root into their bread, a habit which drew from Linnaeus the epithet '*amarus et detestabilis*'. North temperate regions. *H.*

M. trifoliata var. *lapponica*. This variety brought back from Lapland by Mr. Amos Perry in 1937 is quite distinct from the type and may even prove a distinct species. The foliage is much paler in colour, it lacks the metallic lustre and is considerably smaller; the largest leaf-blades of the specimens he brought back being no more than 1 in. across. These either float on the surface or are raised just above water level. Considerable patches of it were growing with the type in a backwater at Petsamo. The plants have not yet flowered with us and until they do the botanical standing of the plant cannot be determined. *H.*

MICRANTHEMUM (Scrophulariaceae) 16 sp. From *mikros*, small, and *anthos*, a flower.

M. orbiculatum resembles a miniature Creeping Jenny with tiny opposite green leaves and small, white or purplish, axillary flowers. It is grown as a marginal plant in wet mud to hide the bare soil amongst taller-growing aquatics, but will succeed in deeper water as a submerged subject. Carolina; Australia. *L.*

MONOCHORIA (Pontederiaceae) 4 sp. Name refers to the one separate stamen.

A genus of rhizomatous plants allied to Pontederia but less frequently cultivated. Propagation by division.

M. hastaeifolia (Pontederia dilatata) has a creeping rootstock and long-petioled, sagittate or cordate leaves, 6 to 7 in. by 5 to 6 in. The inflorescence may be an inch in diameter and carries violet-blue flowers, each having one blue anther and many yellow ones. China; Malay; India; Ceylon. *L.*

M. vaginalis is much like preceding, with long-petioled, oblong-lanceolate leaves and hollow stems. It is eaten when young as a vegetable. Height 2 ft., flowers blue. India; Tropical Africa. *L.*

There are also *M. cyanea* from Australia and *M. ovata* from China. Both *L.*

MYOSOTIS (Boraginaceae) 35 sp. Name in Greek signifying mouse ear, from the shape of the leaves. Forget-me-not; Scorpion Grass; Mouse Ear.

A genus of chiefly blue waterside plants, propagated by means of seed, cuttings or divisions.

M. azorica grows 1 ft. high with oblong leaves and deep indigo flowers with a whitish eye. The plant is hairy throughout and succeeds best in a shady situation. Azores.

M. laxa, a spreading plant with oblong hairy leaves and pale blue flowers with a yellow eye. It is not as fine as *M. palustris* although sometimes grown in its place. North Europe; N. Asia; North America. *H.*

M. palustris with its bright blue florets should be grown in every water garden. In moist, shady locations it reaches 9 to 12 in. in height and will also grow right in the water, flowering freely in May and June. Europe, incl. Britain; Asia; North America. *H.*

M. palustris var. *semperflorens* is a dwarfer plant than preceding (6 to 8 in.) and flowers nearly all the summer. *H.*

MYRIOPHYLLUM (Haloragidaceae) 40 sp. See also page 159.

M. proserpinacoides (Parrot's Feather) is a favourite plant for a fountain basin or for growing at the margins of raised pools. It is a rampant grower, usually destroyed by frosts, although sometimes weathering a mild winter. As a precautionary measure a pan of young cuttings (3 to 6 in. of the growing tip) can be taken about July and kept in a frost-proof house. The leaves, a delicate whitish-green and very feathery, grow in dense whorls around the stem; and reach to a good length, drooping gracefully over the fountain or pond edge and turning up 3 to 4 in. at the tip. Thus they form a living green mantle and make a charming picture when, in late summer, the tips turn crimson. They may also be planted in bundles of moss—kept very moist—and treated in the same way as are Fern Balls. The flowers are white, axillary and inconspicuous. Buenos Aires.

NESAEAE. See Decodon.

ORONTIUM (Araceae) 1 sp. Ancient name of some water plant, said to be from the Syrian river Orontes. Golden Club.

A handsome aquatic perennial for the edge of the pond or for growing in water 12 to 18 in. deep. The roots go down very deep in the mud, so need a good subsoil: once established they are very difficult to lift again. Propagated by seed.

O. aquaticum, at the pond edge, grows 12 to 18 in. high, but in deep water the leaves frequently float flat on the surface, like *Nymphaea*. They are very handsome, being dark velvety-green above, silvery below, and coated with a protective wax covering impervious to water. The plant flowers in early summer, bearing a narrow spadix densely covered with small yellow blossoms. Cattle, hogs and stags are reputed to be fond of the leaves in spring: Kalm in his *Travels in America* states that the Indians eat the dried seeds like peas, boiling them repeatedly to render them palatable and boil them in milk and butter and use them instead of bread. Barton remarks that they also use the roots, after the acid properties have been removed by roasting. North America. *H.*

OXALIS (Oxalidaceae) 800 sp. (1 aquatic). From *oxus*, acid, the leaves have an acid taste.

O. natans. A pretty little plant for 3 to 6 in. of water, with glaucous clover-like foliage and small white flowers floating on the water. Propagated by seed. Cape of Good Hope; Australia. *L.*

PELTANDRA (Araceae) 2 sp. Name from Greek *pelte*, a small

shield, and *andreia*, manliness, referring to the shape of the stamen. Arrow Arum.

Handsome sub-aquatic plants for shallow water at the edge of the pond; producing glossy, sagittate foliage and arum-like flowers. They are easy to colonise and should be grown in clumps for the finest effects. The rhizomes of *P. alba* contain much farinaceous matter and have been used for food. Reproduction by division of the roots in spring.

P. alba (White Arrow Arum) bears broad, arrow-shaped leaves with petioles from 8 to 20 in. long, and a white expanded calla-like spathe. This may be 3 to 4 in. in length and is succeeded by a cluster of red berries. The roots are tuberous. Marshes and springs, East America. *H.*

P. virginica (*P. undulata*) (Green Arrow Arum) is quite distinct and has firm, strongly-veined, bright green leaves—narrowly sagittate and anything from 4 to 30 in. long and 3 to 8 in. wide—also thick fibrous roots. The spathe is green, long and tapering, never properly opening, and succeeded by green berries. Swamps or shallow water, East North America. *H.*

PENTHORUM (Crassulaceae) 3 sp. From *pente*, five, and *horus*, a boundary; the capsule is terminated by five beaks.

P. sedoides (*P. chinense*) (Jacob's Coat; Ditch Stonecrop). A shrubby plant growing 18 in. to 2 ft. high with green lanceolate foliage alternately arranged on a pinkish stem, and greenish-white spikes of inflorescence in late summer. The real beauty of the plant lies in its autumnal raiment, when the leaves become bright crimson, adding a touch of colour to the water garden at a time when it is most needed. Propagated by cuttings. North America. *H.*

PHILYDRUM (Philydraceae) 1 sp. From *phileo*, to love, and *hudor*, water, alluding to the habitat.

A monotypic genus, the species being rather more interesting than beautiful. Propagate from seed.

P. lanuginosum is a greenhouse biennial of erect growth, the lanceolate leaves being densely covered with woolly hair. Clear yellow flowers, solitary or twin, are borne on long spikes, the sepals being much longer than the petals and the whole plant slightly woolly, especially the inflorescence. Height 2 to 3 ft. Stagnant water, Tropical Asia; Australia. *G.*

POLYGONUM (Polygonaceae) 275 sp. From *polus*, many, and

gonu, a knee-joint, referring to the conspicuous joints of the stem. Knot-grass; Knot-weed. See also page 277.

A large genus of varying habits, many not worth cultivating. The following species is amphibious, and so different when growing in water and on land that the varieties might well be taken for two distinct species. Propagated by division of the slips.

P. amphibium (Willow Grass) when grown in water becomes considerably elongated, the stems 2 to 3 ft. long with lanceolate leaves and pretty pink spikes of flowers. Towards autumn the foliage assumes handsome reddish tints. North temperate regions, incl. Britain. *H.*

PONTEDERIA (Pontederiaceae) 3 sp. After Giulio Pontedera (1688-1757), professor of botany in Padua in the seventeenth century. Pickered Weed; Wampee.

A handsome genus of aquatics, grown for their decorative effects and easily propagated by division.

P. cordata. We feel no compunction in stating that this is the finest blue-flowered hardy aquatic in cultivation. A strong-growing perennial which does not become rampant or untidy in appearance, it attains 18 in. to 2 ft. in height, producing smooth, shining olive-green leaves. The inflorescence is borne on spikes, the mealy endosperm forming an attractive background to the closely packed blue flowers. It should be planted in the mud near the edge of the pond under 3 to 5 in. of water. North America. *H.*

P. cordata var. *lancifolia* (*P. cordata* var. *lanceolata* or *angustifolia*) may reach 4 to 5 ft. in height, with longer flower spikes and more lanceolate foliage. Unfortunately it has not proved as hardy as the type, so should be wintered indoors—easily arranged for by growing the roots in large flower pots sunk in the shallow water of the pool during the summer months, lifting these before the danger of frost arises. Strangely enough, in the exceptionally bad winter of 1939 plants survived outdoors at Enfield. *L.*

P. heterantherimorpha. A small aquatic with creeping stems, rooting freely at the nodes. The leaves, narrowly ovate to lanceolate and carried on long petioles, are smooth and entire. The flowers are blue, borne on spikes. The plant is somewhat similar to *P. cordata* but smaller. Brazil; Tropical America. *L.*

P. rotundifolia resembles *P. cordata* except that the flower heads are capitate instead of in an oblong spike, and the leaves are rounder and blunter. Mexico. *L.*

POTENTILLA (Rosaceae) 300 sp. Name from Latin, *potens*, powerful, from the strong properties of some of the species.

P. palustre (Comarum palustre) (Purple or Marsh Cinquefoil; Purple Marshlocks; Cowberry). A herbaceous water plant of little beauty growing about 1 ft. high with 'Strawberry-like' leaves and large dingy purple flowers. Propagated from the stolons. Europe, incl. Britain; North America. *H.*

PRESLIA (Labiatae) 1 sp. Named in honour of the brothers K. B. and J. S. Presl of Prague, authors of *Flora Sicula* and other works. A monotypic genus allied to *Mentha*, thriving in wet soil in shallow water and readily increased by division.

P. cervina (*Mentha punctata*). A non-showy but dainty plant for the pool margin with small, prostrate, aromatic foliage; and leafy stems disposed in dense, many whorled, spikes of lavender-blue flowers. West Mediterranean region; Australia. *H.*

PRIONIUM (Juncaceae) 1 sp. From *prionion*, a small saw, referring to the serrated leaves. Palmiet.

P. Palmita (*P. serratum*). A remarkable plant with the leaves of a pine-apple and the flowers of a juncus. The stem grows 3 to 4 ft. high and is thickly covered with the fibrous remains of old leaf-bases, whilst the inflorescence is most imposing and consists of a large, dense, terminal creamy panicle some 4 ft. long. The rigid, sword-like foliage is used by the South African native for plaiting and thatching, and the leaf-sheaths themselves contain a network of strong black fibre, which he uses for brush making.

This extraordinary plant may be grown in a pot outdoors for the summer but is subject to frost. In its native habitats it grows to such an extent as to choke the rivers. Propagation by means of the runners. South Africa; Australia. *L.*

RANUNCULUS (Ranunculaceae) 300 sp. Name, a diminutive of *rana*, a frog, since frogs and buttercups delight in marshy places. See also pages 166 and 281. Propagated by seed or division.

R. Flammula is rather like *R. Lingua* but much smaller, usually less than 1 ft. high. Britain. *H.*

R. Lingua grows 2 to 3 ft. high with lanceolate, undivided leaves and branching stems holding large, yellow, buttercup flowers with shining petals. It blooms from June to September and is native to Europe, including Britain; also temperate Asia. *H.*

R. Lingua var. *grandiflora* (Great Spearwort) differs only in its greater size. It is a fine aquatic for the water garden. *H.*

RUMEX (Polygonaceae) 100 sp. The old Latin name used by Pliny; of uncertain origin. Dock.

A coarse, weedy genus of little horticultural value; the following species sometimes planted for bold effects along water courses. Propagated readily by seeds or divisions.

R. Hydrolapathum (Great Water Dock). A stout perennial, 4 to 6 ft. high, having bold, dark green, dock-like leaves which later assume handsome, crimson autumnal effects. The flower spike is very large and should be removed to prevent seed falling about too freely. The plant is interesting inasmuch as it sometimes produces aerating roots like a Mangrove. Europe, incl. Britain. *H.*

SAGITTARIA (Alismataceae) 33 sp. See also page 168.

Handsome aquatics for growing in 5 to 6 in. of water, and often succeeding in greater depths. The plants are reproduced by division of the tubers. Arrow Head.

S. gracilis var. *flore pleno* (*S. variabilis* fl. pleno) has double flowers. *H.*

S. lancifolia. An erect plant 2 to 5 ft. high, with several whorls of flowers and lanceolate-oblong or rarely linear leaves (never sagittate). North America; West Indies. *G.*

S. lancifolia var. *angustifolia*. Smaller and with narrower leaf-blades than the type. *G.*

S. latifolia (*S. variabilis*) (Duck Potato). Very variable in stature and the size of the leaves; ranging from a few inches to 3 or 4 ft. tall. The leaves are mostly broadly arrow-shaped with long basal lobes, and the flowers clear white, about 1 in. across. North America. *H.*

S. macrophylla. A Mexican species with large green leaves which pass to yellow and reddish-bronze with age. It is not really hardy, but we have wintered it outside several years under 6 to 8 in. of water. Height about 3 ft. and flowers white.

S. montevidensis. Introduced into this country from Buenos Aires in 1883, this exceedingly handsome, free-flowering aquatic is unfortunately tender to frost, so must be wintered indoors. The giant of the family, it frequently reaches 6 ft., with aerial leaves 1 to 2 ft. long. The flowers are very large, 2 to 3 in. across, snow-white with a purple blotch at the base of each petal. *L.*

S. pugioniformis has sword-shaped foliage and white flowers with yellow anthers. Height 2 ft. North America. *H.*

S. sagittifolia has a thick tuberous rhizome (almost round),

scapes of white flowers 15 to 18 in. high and varying types of foliage. Being of a stoloniferous nature it is inclined to become a nuisance unless kept within bounds. The tubers and rhizomes are edible. Europe, incl. Britain; Asia. *H.*

S. sagittifolia var. *japonica* is a greatly improved form of the type with larger flowers and bigger foliage. *H.*

S. sagittifolia var. *japonica flore pleno*, a very beautiful double-flowered form, the closely packed spikes resembling a gigantic double Stock. Being slower of growth than the type, it may safely be introduced to the small pool, planting it in loam under 5 to 6 in. of water. This plant is undoubtedly one of our finest hardy aquatics. *H.*

S. sagittifolia var. *variegata*. A variegated leaved form (which we have never seen) offered by Henkel in 1906 and now apparently lost to cultivation. *H.*

SAURURUS (Saururaceae) 2 sp. From *sauros*, a lizard, and *oura*, a tail, alluding to the form of the inflorescence. Lizard's Tail.

Pretty, hardy aquatics for shallow water, with handsome cordate foliage and terminal racemes of flowers. Propagated by division.

S. cernuus (American Swamp Lily) grows 1 to 2 ft. high—although reputed to attain 5 ft. in its native habitat—and carries dense spikes (4 to 6 in.) of nodding, fragrant white flowers, with bright green heart-shaped leaves. North America. *H.*

S. chinensis (*S. Loureirii*; *Neobiondia Silvestrii*) grows 12 to 16 in. high from a stout rhizome: with cylindrical spikes of yellowish-white flowers and oval leaves 4 to 5 in. in length. China; Japan. *H.*

SCROPHULARIA (Scrophularinaceae) 150 sp. Name from the disease scrofula, for which the plant was thought to be a remedy. Figwort.

Plants of weedy habit, the following sometimes grown at the water's edge. Propagated by seed or cuttings.

S. aquatica (Water Figwort). A tall, glabrous plant with a square stem 1 to 2 ft. long and smooth, heart-shaped, somewhat nettle-like leaves. The flowers, borne in repeatedly forked, loose panicles, are of a dingy greenish-purple colour. The leaves have a strong unpleasant smell and bitter taste; a decoction is used by farmers to cure the scab in swine and they also have medicinal properties. Burnett says that they cannot be very unwholesome

plants because, during the siege of La Rochelle by Cardinal Richelieu in 1628, the garrison supported themselves by eating the roots of *S. aquatica*, which since that time has been known by the French as *herbe du siège*. Europe, incl. Britain; Caucasus. *H.*

S. aquatica var. *variegata* is of more decorative value by reason of the broad white marginal band present on the foliage. *H.*

SCUTELLARIA (Labiatae) 200 sp. From Latin *scutella*, a salver or a stand for vases, alluding to the form of the fruiting calyx. Skull-cap.

A genus of annual or perennial, stove, greenhouse or hardy plants and shrubs, the following being suitable for the damp soil at the water's edge. Propagation by seed or division.

S. galericulata. A handsome plant growing 12 to 15 in. high. with large, bright blue, snapdragon-like flowers arranged in pairs, and oblong tapering leaves. Europe, incl. Britain; North America. *H.*

S. minor. A small bushy herb, 4 to 6 in. high, with egg-shaped leaves and small dull purple flowers. Britain. *H.*

SENECIO (Compositae) 2000 sp. Latin name of the plant, said to be derived from *senex*, old man, in allusion to the hoary pappus.

S. japonicus. A handsome and decorative plant at the edge of pool or for naturalising in the damp mud surround. Growing about 5 ft. high, the leaves are nearly a foot across and divided into nine segments. Slightly branched flower spikes support numbers of rich orange flowers—each frequently 3 in. in diameter. Japan. *H.*

S. Smithii, a useful subject, as it will grow in shade, producing very dark green leaves and creamy-white heads of flowers. There is a very fine clump of the plant in the lake at Myddelton House; Mr. Bowles says that it is a slip from the original plant brought back by Captain Cook. Cape Horn. *H.*

SONCHUS (Compositae) 70 sp. Old Greek name of uncertain origin.

S. palustris (Marsh Sow Thistle). A very rare native of Eastern England which makes an excellent plant for the water garden. Growing 5 to 8 ft. high from a compact rootstock, it bears long, narrow leaves and showy panicles of large Dandelion flower heads. The plant does not seem to become rampant and should be situated on the banks where the roots may get down into the water. Propagated from seed. Europe. *H.*

SPARGANIUM (Typhaceae) 15 sp. An old Greek name used by Dioscorides for a plant with sword-like leaves, and derived from *sparganon*, a band. Bur Reed.

A coarse-growing genus of aquatics only suitable for naturalising in wild garden settings or as cover plants for wild fowl. Propagated by division.

S. angustifolium (*S. eurycarpum*) on stout branching stems 3 to 8 ft. high, carries numerous round heads of inflorescence and flat grassy leaves. North America. *H.*

S. natans, a rare native plant, has very long, transparent floating leaves and a solitary flower head. Europe, incl. Britain. *H.*

S. ramosum (Bede Sedge) is a large aquatic which when out of flower might be mistaken for *Iris Pseudacorus*. The leaves are sword-shaped, triangular at the base, and the flowers collected into round, spiky heads arranged in terminal and axillary spikes. The stems are branched and have been used for making pepper. Europe, incl. Britain; North America; Barbary; Siberia. *H.*

S. simplex is smaller than preceding and has an unbranched flower spike. North America; Europe; Siberia. *H.*

STACHYS (Labiatae) 200 sp. Name from the Greek *stachys*, a spike, from the arrangement of the flowers. Woundwort.

A large, genus, varying greatly. The following species, suitable for the water garden, may be increased by division or cuttings.

S. palustris. A branched, hairy plant, 2 to 4 ft. high, with spikes of bright purple flowers, six to eight in a whorl. The narrow, crenate leaves resemble a nettle-leaf; the plant has a peculiar pungent smell. Europe, incl. Britain. *H.*

TENAGOCHARIS (Butomaceae) 1 sp. Name from the Greek *tenagos*, a shallow or lagoon, and *charis*, ornament. This monotypic genus is somewhat like *Butomus*; whence the synonym *Butomopsis*.

T. latifolia (*Butomopsis lanceolata*; *B. cordofana*) is an annual growing about 2 ft. high. It has long-petioled basal leaves of a lanceolate shape. The flower stem rises above the foliage and carries four to fifteen white flowers in an erect umbel. Africa; India; Australia. *G.*

TEUCRIUM (Labiatae) 100 sp. Name from Teucer, King of Troy, who is said to have been the first to use it in medicine.

T. Scordium (Water Germander). A rare native growing only a few inches high with distant whorls of purplish-red flowers and

oblong, serrated leaves. The plant was once used in medicine as a tonic and protection against infectious diseases. Propagated by cuttings or divisions. Europe, incl. Britain; temperate Asia. North Africa. *H.*

THALIA (Marantaceae) 7 sp. Named after Johann Thal (1542-1583), a German naturalist who wrote a flora of the Herz district.

The *Thalias* are very handsome plants, succeeding best when planted in rich loam compost in shallow water or wet soil. The foliage somewhat resembles that of *Canna* or *Hedychium*, and they do well accorded the same treatment as these plants. Propagation may be effected by division of the rootstocks.

T. dealbata is sufficiently hardy to withstand our winters providing that the roots are 2 ft. below water level, or they may be grown in large flower pots and taken into a house for the winter. Growing 3 to 5 ft. high, the plant carries large, long-petioled canna-like leaves and erect panicles bearing many small purplish flowers. The plant is dusted over with a minute white powder which gives it a pretty glaucous appearance. It is a most desirable subject to mass at the side of the pond for bold effects. North America.

T. divaricata is larger and stouter in all its parts than *T. dealbata* and grows 5 to 10 ft. high, with zigzag spikes of purple flowers. It also lacks the mealy appearance of that plant. North America. *H.*

TRAPELLA (Pedaliaceae) 1 sp. Name meaning a little *Trapa*, which plant it much resembles in habit.

T. sinensis. A beautiful plant recently introduced into cultivation, with long trailing stems and smooth, deltoid serrated leaves floating on the water, upheld by swollen footstalks as in *Trapa*. The flowers are tubular, yellowish and succeeded by curious fruits with four long, slender spines. The plant may be a decided acquisition to the indoor aquarium. China; Japan. *G.*

TRIGLOCHIN (Scheuchzeriaceae) 12 sp. Name from the Greek *treis*, three, and *glochis*, a point, referring to the three-pointed fruit of some of the species. Arrow-grass.

Grassy-leaved plants found in salt- and fresh-water marshes in many parts of the world. They are of little beauty and although the following species is occasionally listed, it has little to recommend it. Increase by divisions.

T. maritima has thick leaves and a scape $2\frac{1}{2}$ ft. high, carrying an inconspicuous flower spike. Europe, incl. Britain. *H.*

TYPHA (Typhaceae) 11 sp. From the Greek *typhos*, a marsh. Reed Mace.

Aquatic plants with creeping rootstocks, grassy leaves and long 'poker-like' heads of inflorescence. Grown in colonies, typhas present a stately and decorative aspect, but some provision must be made to prevent their overrunning the pool—best arranged for by planting the roots in prepared pockets or large boxes. Propagation is effected by division of the root-stocks or seed. They may be grown in 1 to 6 in. of water.

For centuries the genus has been economically useful; like other reed-like plants the stems and leaves make good thatching material and can also be woven into mats and baskets. Coopers find the long, flat leaves of value to place between the staves of barrels and casks to render them watertight, whilst John Smith, in his *Dictionary of Economic Plants*, speaks of bread being made in country districts from the pollen in the staminate flowers. The pollen also, by reason of being exceedingly inflammable, has been used by firework-makers as a substitute for Club Moss, and a vain attempt has been made to utilize the silky hairs of the fruit for making velvet. The down was at one time collected by country people to stuff pillows and cushions and is still gathered for this purpose in parts of Russia and Lapland. Dr. Clarke, in his *Travels*, speaks of the esteem with which the young stems were held as a vegetable by the Cossacks. He says it makes a cool and pleasant dish and becomes of the finest quality when grown in the neighbourhood of the Don. Medicinally, the rootstock has been used in Eastern Asia for dysentery.

T. angustifolia (*T. domingensis*). One of two British species. An extremely graceful plant with slender, linear leaves, and stems 5 to 10 ft. high. The flower spike is dark brown and monoecious; male and female flowers separated by several inches of stem. North America; Europe; Asia; Tropical America. *H.*

T. elephantina. A giant species of little garden value because of its great size and width, this being roughly double that of the preceding. Mediterranean; West Indies. *H.*

T. latifolia (Cat-o'-nine-tails; Marsh Beetle; Reed Mace). Often wrongly known as 'Bull Rush', *T. latifolia* is a fine hardy subject for naturalising in large stretches of water. It grows

4 to 8 ft. high, with long grassy leaves 18 to 24 in. by 1 to $1\frac{1}{2}$ in. wide. The flower is in a close cylindrical spike 6 to 9 in. in length and about 1 in. in diameter; the staminate flowers (light brown) being immediately above the pistillate (dark chocolate-brown). Europe, incl. Britain; North America. *H.*

T. latifolia var. *elator* (*T. elator*) has narrower leaves and shorter spikes. Europe. *H.*

T. Laxmannii (*T. stenophylla*) is a slender plant, $2\frac{1}{2}$ to 4 ft. high, with very narrow semi-cylindrical leaves which are grooved inside and convex without. The flower spike is brown and shows a margin of stem between staminate and pistillate flowers. South-East Europe to China. *H.*

T. minima. A beautiful miniature form that only grows 12 to 18 in. high, with narrow, rush-like foliage and diminutive, round, rusty-brown flower heads. Europe; Caucasus and Asia. *H.*

T. Muelleri (*T. angustifolia* var. *Muelleri*). A New Zealand species resembling *T. angustifolia* but smaller. The pollen was formerly collected by the Maoris, who mixed it with water for making cakes; whilst the starchy rhizomes they baked and ate as a vegetable. The leaves are still used for covering the roofs of their houses. *H.*

T. Shuttleworthii grows 3 to 4 ft. high, with linear leaves a few inches longer than the cylindrical flower spikes. Europe. *H.*

Other Typhas are: *T. capensis*, Africa; Australia. *T. glauca*, France. *T. javanica*, Tropical Asia, and *T. Schimperii*, Abyssinia.

TYPHONODORUM (Araceae) 1 sp. Name in Greek meaning stormy wind and gift.

T. Lindleyanum. A striking plant with the habit of a Zantedeschia, suitable for growing in deep water in the greenhouse. The stem is thick and stout (4 to 10 ft. high and 4 to 12 in. in width) and carries huge hastate or deeply cordate leaves. The inflorescence is a typical arum spathe, 18 in. to 2 ft. in length, and bright yellow with a green spadix. The seeds are edible and $\frac{1}{2}$ to 2 in. across. Madagascar; Tropical Africa.

TYTONIA. See HYDROCERA.

VERONICA (Scrophulariaceae) 250 sp. A medieval name of doubtful derivation; perhaps a variant of Betonica.

The aquatic members of this genus are inclined to be weedy and have little garden value. Propagated by seed, division and cuttings.

A. americana (American Brooklime) may grow up to 3 ft. high, with leafy stems and axillary racemes of lilac or nearly white flowers. North America. *H.*

V. Anagallis (Water Speedwell), a smooth erect plant 6 to 18 in. high, sometimes rather fleshy; with narrow, tapering, sessile leaves and axillary racemes of small pale blue or flesh-coloured flowers. Streams and ditches, Britain; north temperate regions. *H.*

V. Beccabunga (Brooklime). A succulent plant 9 to 12 in. high, with elliptical smooth leaves and axillary clusters of bright blue flowers. Both this and the preceding species need to be kept within bounds. It is sometimes used as a spring salad, and according to Culpepper 'being fried with butter and vinegar, and applied warm, it helpeth all manners of swellings and inflammations'. North temperate regions. *H.*

VILLARSIA (Gentianaceae) 10 sp. Named in honour of Dominique Villars (1745-1814), professor at Grenoble.

A genus of pretty water-loving plants—chiefly Australian—the aquatic species requiring to be grown in water and the marsh-loving sorts in very wet soil. Propagation may readily be effected by division or by seeds.

V. capitata grows about 6 in. high with leafy, slightly-branched stems carrying globular depressed heads of yellow flowers (about $\frac{1}{2}$ in. in diameter). The leaves, borne on long petioles, are almost round, sometimes toothed and less than an inch across. Australia. *L.*

V. Nymphoides. See *Limnanthemum Nymphoides*.

V. ovata (*Menyanthes ovata*), growing 6 to 12 in. high, has clusters of oval foliage and slender scapes carrying racemes of pretty citron-yellow flowers, copiously fringed at the petal margins. Australia; Cape of Good Hope. *L.*

V. parnassifolia carries small, long-petioled ovate or orbicular leaves and leafless flower stalks—1 to 2 ft. high—with soft yellow flowers. Australia. *L.*

V. reniformis (*Menyanthes exaltata*; *M. sarmentosa*) will grow from 1 to 2 ft. high, carrying panicles of yellow flowers, each $\frac{3}{4}$ to 1 in. across, the inside lobes being heavily fringed and bearded. The kidney-shaped leaves, on long petioles, grow in a dense clump around the plant. Australia. *L.*

WISNERIA (Alismataceae) 3 sp. Named after Julius Wiesner

(1838-1916), professor of botany at Vienna. Plants with the habit and condition of *Alisma*.

W. Schweinfurthii. An African aquatic with spikes of small pinkish flowers and oblong-lanceolate leaves arising from a short rhizome. East Africa. *L.*

Others are *W. filifolia* from Madagascar and *W. triandra* from India. *G.*

XANTHOSOMA (Araceae) 40 sp. From the Greek, *xanthos*, yellow, and *soma*, a body, referring to the large depressed stigma. Spoon-flower.

Handsome aroid plants, usually cultivated for stove decoration, with thick fleshy corms, large arrow-shaped foliage and arum flowers. A few make good aquatics but need a rich planting compost. The young leaves of *Xanthosoma* are said to be superior to spinach when properly cooked, whilst the rhizomes of some are also edible. Propagation by division.

X. Lindenii (*Phyllotoenium Lindenii*). A showy variegated plant with large arrow-shaped leaves (12 in. or so in length) marked with white along the midrib and marginal veins. They are of firm texture and stand a good deal of rough usage. New Granada. *G.*

ZANTEDESCHIA (Araceae) 10 sp. Named after Francesco Zantedeschi or Giovanni Zantedeschi, both of whom wrote on Italian plants. *Calla*.

The so-called *Calla* of popular fancy, *Z. aethiopica* has for some generations been a favourite as a pot plant for greenhouse culture and may be tried outside for naturalising in damp places at the pool side or even in the water itself. In the water garden, a sunny sheltered position should be selected and the crowns of the plants submerged sufficiently to escape frost (about 9 in.). Or they can be grown outside in the summer and dried off for the resting period.

Being so readily adaptable to aquatic culture, it is a pity the genus is not more extensively used; few plants do so well, for instance, at the base of a fountain or disguise so ably unsightly objects (such as hydrants) at the pool side.

Rich loamy soil is essential with abundance of water during the growing season. Increase by seed or divisions.

Z. aethiopica (*Calla aethiopica*; *Richardia africana*) (Arum Lily; Lily of the Nile). A stout robust plant with glossy sagittate



THE WATER CROWFOOT CARPETS THE POOL IN EARLY SPRING



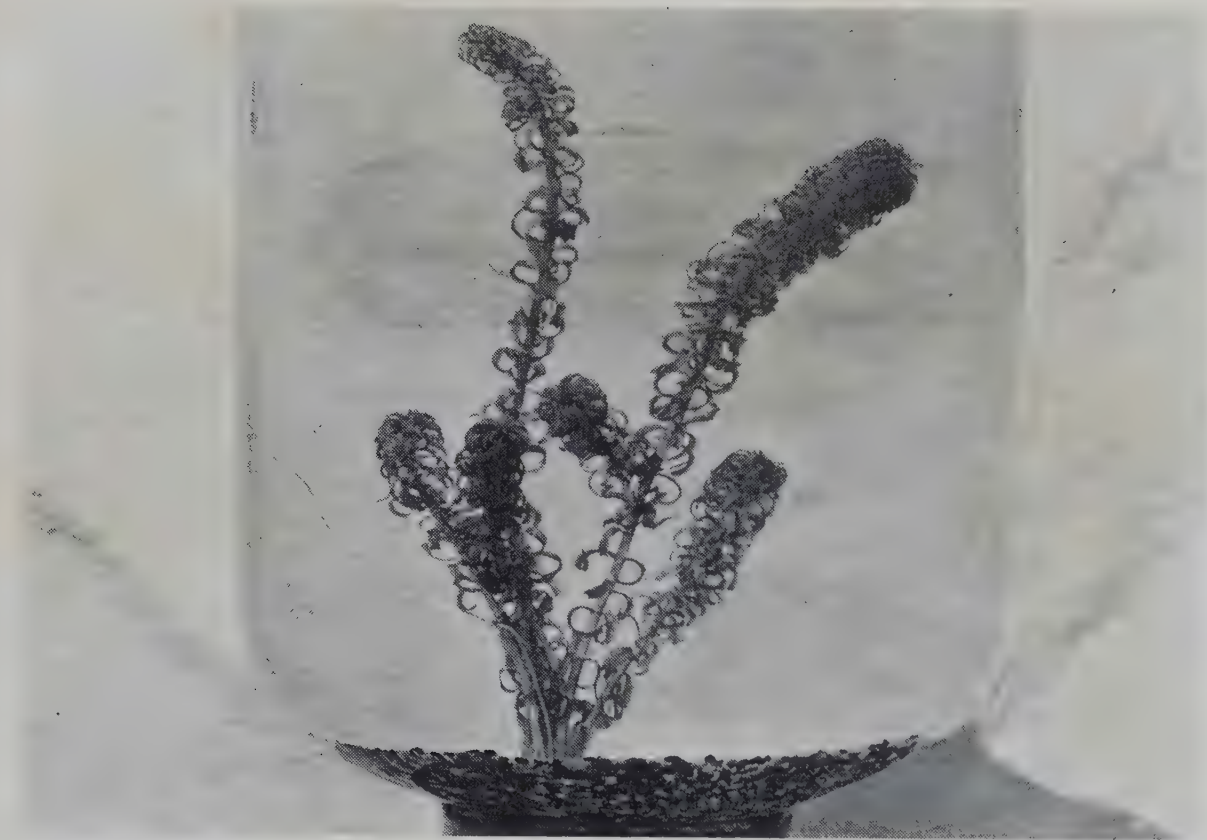
Where the lowliest reed beside the stream is clothed with beauty.

LONGFELLOW



*Now the meadows are blooming with flowers of various colours,
and with untaught throats carol the garrulous birds.*

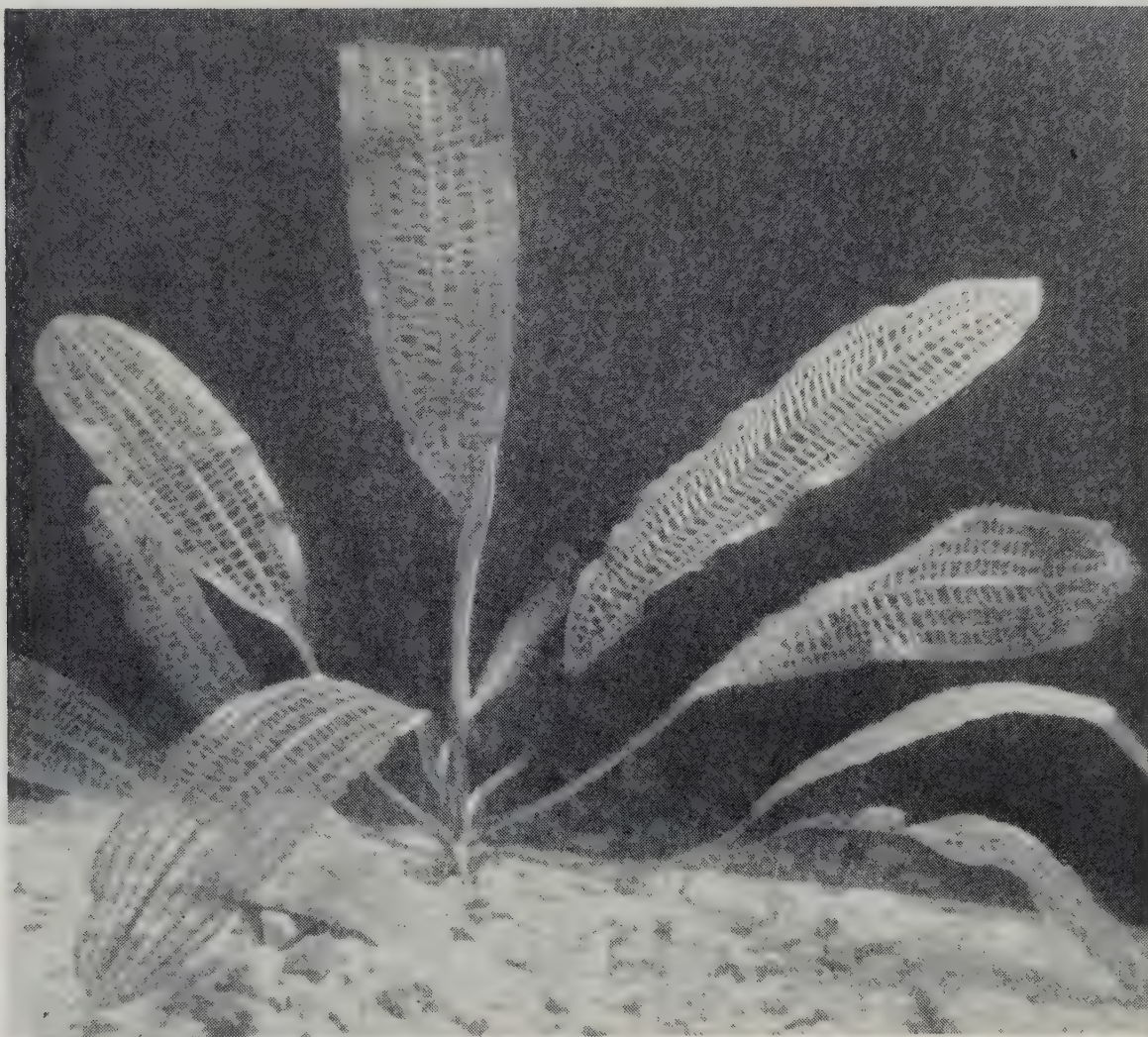
OVID. Trans. by LONGFELLOW



LASAROSIPHON MAJOR (ELODEA CRISPA)



HOTTONIA PALUSTRIS, THE WATER VIOLET



APONOGETON FENESTRALE, THE MADAGASCAR LACE PLANT



LIMNOPHILA (AMBULIA) SESSILIFLORA

leaves and large white arum flowers, 3 to 10 in. long. These are very fragrant: occasionally sports occur with double or treble spathes. Height 2 to 3 ft. South Africa.

Z. aethiopica var. *minor* *Little Gem* resembles the type but is much smaller, growing only 12 in. high with a 3 to 4 in. flower spathe. *H.*

CHAPTER IX

Floating Aquatics

FLOATING AQUATICS play a very definite part in the well-being of every aquarium which has sufficient top-light to maintain their growth; for, not only do they form an attractive finishing touch, but they afford valuable shelter and natural food to the animal inmates. Many are important aerators, and hold bubbles of oxygen for a long time (even far into the night), until they are gradually absorbed by the water. Certain tropical fish will build nests among the leaves: whilst the dense masses of *Riccia* and *Lemna* form happy hunting grounds for small fry. Again, the long hanging roots of *Pistia* and *Eichhornia* make capital egg depositories, and, where there is excess of toplight, provide welcome shade. They are, moreover, a perpetual source of interest to the keen aquatic student; and need little attention after being introduced to the aquarium, beyond occasional, drastic thinning out. This is essential if the plants are not to cover the surface completely, and so exclude all air and light: and necessary owing to the rapidity with which some of the species spread.

It is advisable to keep stock pans of the more delicate sorts, as some of them favour very shallow water for reproductive purposes. One then has the satisfaction of knowing that there are plants in reserve, should accident befall or fish devour the aquarium stock. An inch or two of loam should be placed in a shallow pan, firmly rammed, and about half an inch of water added. The plants may then be placed on the surface, and the pans stood in a warm, light position.

A number of floating aquatics are native to our ponds and ditches, but one should be careful of introducing these to the fish tank, owing to the danger of including unwelcome plant or animal parasites—the roots of Duckweed are a favourite haunt of Hydra.

AZOLLA (Salviniaceae) 6 sp. Name from the Greek *azo*, to dry, and *ollo*, to kill; signifying killed by drought.

The Azollas are so dainty in appearance that the English name of Fairy Moss is no misnomer. Increasing rapidly by self-division

they soon become established, and cover the water with a green moss-like carpet. Exposed to sunlight or towards autumn, they assume beautiful red tints, although some of the species are always a deep red-brown colour. The plants die down and disappear in the autumn—to renew life in the following spring. *Azolla* should be excluded from the garden pool, as it spreads rapidly, and soon becomes a nuisance.

A. caroliniana is the species most generally known and, although not a native, is occasionally found naturalised in ponds and lakes. The fronds are half to an inch long, of soft lacy texture, pale green becoming red later in the season. It is found in the Southern United States and California, through Tropical America to Buenos Aires.

A. filiculoides is also quite well known to the aquarist. The fronds are larger than in *caroliniana*, 1 to 2 in. long, greatly divided and pale green tinted with rose. Where the plant is growing well, as in warm water, the fronds mass together and stand up in a vertical position. It is a native of the west side of South America and found in the Andes at a height of 16,000 feet.

A. nilotica bears very finely divided, leafy fronds, sparsely arranged on a long trailing leafless stem; long tufts of roots hang down from the nodes. It should be a valuable plant to the fish breeder but as far as we know is not in cultivation.

A. pinnata from Australia has firm, red-brown, leafy fronds half to one inch in length, and bears an abundance of conspicuously feathered root fibres.

A. pinnata var. *africana* has smaller, less densely clothed fronds than the type; it comes from Tropical Asia and Africa.

A. rubra bears firm, dainty fronds of a rich red-crimson shade, roughly half to an inch in length. It is a native of Australia and New Zealand.

CERATOPTERIS (Ceratopteridaceae) 3 sp. Name from the Greek *keras*, a horn, and *ptēris*, a fern.

Ceratopteris are very succulent tropical ferns, the only true aquatic members of the family, and grow floating on the water or rooted in the soft mud beneath. They need a warm, moist atmosphere, a subdued but not poor light, and a temperature round about 75° F. Stock pans should always be kept in reserve, for this plant soon dwindles away when subjected to cold or in a poor light. All the species are viviparous, and reproduce them-

selves by means of baby plants which appear in profusion on the edges of the matured leaves. These may be detached, when an inch or two across, and floated in very shallow pans of loam and water.

C. deltoides, a native of Florida, Louisiana and Jamaica, is the largest of the family. The barren fronds are thick and succulent, twice as large as in *C. pteridoides*, but lying under the water instead of floating. The fertile leaves are erect, very finely divided and protrude above the surface.

C. pteridoides is popularly known as the Floating Fern, and bears broad, floating sterile leaves of a pale green colour. These have a wavy margin and are borne in the form of large rosettes; but the fertile fronds are taller, much divided, and stand up from the centre of the plant. The feathery roots hang down 8 or 9 in. into the water, so are useful for fish breeding. The floating fern comes from South America, where the foliage is occasionally gathered by the natives, and cooked and eaten as greens.

C. thalictroides (Water Sprite), although naturally an annual, may be wintered in a warm tank: so is frequently used as a submerged plant. The fragile, pale green foliage is very attractive, but fertile and sterile fronds are quite distinct, the former being deeply segmented (somewhat similar to Cabomba), whilst the sterile foliage, narrowly deltoid and deeply cut, looks like parsley foliage. The fronds of this species are also eaten as a vegetable in the Indian Archipelago.

EICHHORNIA (Pontederiaceae) 6 sp. (1 floating). Named after J. A. F. Eichhorn, a Prussian Minister. Water Hyacinth.

Eichhornea speciosa (crassipes) is perhaps the showiest of all floating plants and so grotesque in appearance as to be classed amongst the oddities of the vegetable kingdom. The shiny pale green foliage grows in perfect rosettes; it is smooth and cordate, with the leaf petioles inflated to an extraordinary degree. Being filled with spongy aerenchyma tissue they become extremely buoyant and float with effortless ease on the water surface. The flowers are showy but sparsely produced, and only last a few hours. Borne aloft on spikes, they are of a delicate pale violet shade with a conspicuous gold and blue peacock-eye marking on the upper petals. The long purplish roots hanging down 10 or 12 in. into the water are perhaps the finest possible medium for ova deposition; and are used extensively for fancy goldfish

breeding. Reproduction is by means of stolons, and under favourable circumstances the plant spreads alarmingly. In the St. Johns River in Florida it grows so rapidly at times as to become a menace to navigation. Thousands of pounds have been expended, over a period of years, in a vain attempt to kill the Water Hyacinth without damaging other plant and animal life in the river. It is even used as fodder on Mexican ranches when nothing better is available. Perhaps fortunately, the plant is not hardy in this country, and if grown in the outside pool must be wintered indoors away from frost. The easiest way of carrying it over the winter is to pot the roots (using drainage), afterwards storing the pot in a subdued light. Keep the soil just moist during the winter months and float the plant in water again about May. It is native to Africa, Australia and South America.

E. speciosa var. *major* is a garden variety, slightly larger than the type, with rosy-lilac flowers.

E. speciosa var. *aurea* has yellow flowers.

HYDROCHARIS (Hydrocharidaceae) 1 sp. Name derived from the Greek *hudor*, water, and *chara*, elegance. Frogbit.

H. Morsus-ranæ is a graceful floating plant for the aquarium or pool, with small kidney-shaped leaves about $1\frac{1}{2}$ in. across, bright green in colour, and attractive three-petalled white flowers. The method of reproduction is interesting. With the approach of autumn terminal buds are formed, the parent plants decay, and the buds drop off and sink to the bottom of the pond, there to remain until the following spring when they rise to form new plants. It is certainly the best of our native floaters, but has one disadvantage inasmuch as snails (especially *Limnaea*) delight to feed on the soft spongy leaves and quickly spoil the appearance. The long trailing roots are also liable to become tangled with algae.

LEMNA (Lemnaceae) 12 sp., including 4 British. From the Greek *lepis*, meaning a scale. Water Lentils; Duckweed; Duck's Meat.

Lemnias are found floating on stagnant waters in most quarters of the globe, although there are no representatives in the Arctic, covering the surface with a green carpet of small floating leaves. Owing to the prodigious rate at which they spread the genus should never be introduced to the outside pool (in spite of their nourishing food value to ducks and fish) unless the pond owner is prepared to spend half his days fishing them out again. In the aquarium, however, they are of value. Goldfish and the tropical

Scat (*Scatophagus argus*) enjoy eating the fronds; they provide shade and so destroy algae growth in the water—keeping the tank in crystal-clear condition.

L. cyclostasa grows in colonies of about eight together. It is green, and native to California, Mexico and S. America.

L. gibba (Thick Duckweed) has fronds almost round, about one-third inch in diameter, bright green above and grey beneath. It is often found mixed with other duckweeds. Europe and North America.

L. minor is the commonest of all, with small ovate fronds, light green above and deep green beneath. One rootlet hangs down into the water from each frond. Europe.

L. minima from Florida and California is almost identical with the preceding.

L. perpusilla has thick unsymmetrical fronds growing in colonies of two to six. It is found in Florida.

L. polyrhiza (*Spirodela polyrhiza*) is the largest of the duckweeds, bearing round, thick fronds about half an inch in diameter. They are deep green above and purple beneath, each frond bearing several roots. Tropical America and Europe.

L. trinervis, from New Jersey, has thin round fronds with a single rootlet attached to each.

L. trisulca (Ivy-leaved Duckweed) is the prettiest species, with light green, transparent fronds of an elliptical shape, about half an inch long. The young fronds grow at right angles to the old ones and each has one root fibre. It remains submerged except in the height of summer and is an excellent plant for keeping water clear. Europe and Tropical America.

L. valdiviana has small green fronds, provided with numerous pitted stomata. It is a native of the Southern United States and South America.

LIMNANTHEMUM (*Gentianaceae*) 20 sp. From the Greek *limne*, a swamp, lake or pool, and *anthemon*, a flower. Literally, a 'flower of the pool'. See also p. 106.

L. lacunosum (*Nymphoides lacunosum*) (Floating Heart). Has small round leaves, 1 to 2 in. across, green above and purplish beneath with tiny yellow flowers. Small banana-shaped tubers, 1 to 1½ in. in length, hang down into the water and create a most curious effect. For the best results the plant should be grown in shallow water. It blooms during July and August. North America.

L. trachyspermum (aquaticum) (Fairy Water-lily) is much stouter and larger than preceding, with round spongy foliage 2 to 6 in. across, reticulated and pitted on the lower surface, and pure white flowers borne close to the leaf on the leaf stem. Thick tubers hang down into the water. It is a native of Mexico and Florida.

LIMNOBIUM (Hydrocharidaceae). 3 sp. From the Greek *limne*, a marsh or pool, and *bios*, life. Literally, 'living in pools'.

L. Boscii (Spongia) (American Frogbit). This little floater is very similar to our European Frogbit except that it is lighter in colour, and the foliage somewhat larger and more pointed. Also it remains in character throughout the winter instead of resting like our native form. The plants are stoloniferous and bear abundant feathered, purplish trailing roots. *Limnobia* is a favourite in the tropical aquaria especially with the Labyrinth fishes, who delight in anchoring their bubble nests to it.

L. Sinclairii is a floating, stoloniferous aquatic, with oval to rounded leaves ($\frac{1}{2}$ to $1\frac{1}{4}$ in. in length) arranged on short petioles. The flowers are inconspicuous; male and female being found on the same plant. South America.

L. stoloniferum (Trianea bogotensis). This little plant is only suitable for the warm water aquarium, as it comes from Tropical America and quickly feels the cold. The dark green leaves are quite smooth, almost round, $\frac{1}{2}$ to $\frac{3}{4}$ in. across, and supported by spongy tissue on the under-surfaces. They are borne in groups, the upper leaf slightly overlapping the one beneath. As with so many floating aquatics, male and female flowers are carried on separate plants: neither are of any horticultural value.

NEPTUNIA (Leguminosae) 12 sp. (1 floating). Name derived from Neptune.

N. oleracea (plena) (Water Sensitive) is an aquarium plant of outstanding beauty, but very delicate and extremely difficult to cultivate. It has a floating stem, grooved beneath and rooting at the nodes. The under-surface is covered with white spongy tissue, full of air cells, which keeps it afloat. The foliage resembles *Mimosa pudica* and, like that plant, is extremely sensitive both in leaflet and petioles. The flowers are in heads, the lower ones male or neuter and upper ones female. They are bright yellow at the head and brown below.

PHYLLANTHUS (Euphorbiaceae) 60 sp. (1 floating). Name from

Greek, *phyllon*, a leaf, and *anthos*, a flower, because the flowers grow upon the edges of the leaves.

P. fluitans is in our opinion the most beautiful of the smaller floating aquatics. Orbicular leaves rise alternately from a fragile stem (rather after the fashion of *Salvinia*); they commence life bright crimson, turning paler and paler with age, until they finally assume a delightful green shade. As the young leaves lie partly overlapping the older ones, a very pretty colour combination is thus obtained. Bright red fibrous roots hang down into the water; several plants add a bright touch of colour to the aquarium.

PISTIA (Araceae) 1 sp. Name from *pistillum*.

P. stratiotes (Water Lettuce) is a fine ornamental plant for the tropical aquarium, forming rosettes of pale green, fan-shaped foliage, and long white feathery rootlets. A stock pan should be kept in reserve as the plant prefers to grow in shallow water where the roots may reach the soil. In the West Indies it is supposed to produce malaria, although it seems more probable that the thick floating masses harbour and protect the mosquito which carries the germ.

RICCIA (Ricciaceae) sp. (2 floating). Named after Pietro Francisco Ricci, a Florentine botanist. Crystalwort.

R. fluitans (Ricciella of Braun) is a useful aquarium plant as it forms sanctuary for the fry of viviparous fish and is a good surface oxygenator. The plant bears masses of pale green foliage, very much segmented and packed tightly together.

R. natans (Ricciocarpus of Corda) has star-shaped bodies with serrated edges and is equally useful in a fish tank. Neither species is really hardy although they will survive outdoors in very sheltered positions.

SALVINIA (Salviniaceae) 14 sp. Named after Antonia Maria Salvini, 1633-1729, an Italian scientist. *Salvinia* species are among the most popular small aquatics for the tropical aquarium. They are annuals, generally of a pale green colour, with slender stems bearing rather broad, two-ranked leaves and are covered with fine silky hairs which makes them soft to the touch. The plant is supposed to have no true roots, and what appears to be rootlets are believed to be finely dissected leaves; one of which occurs with each pair of foliage leaves. It is as well to keep a stock pan as aquarium fish are apt to devour the roots(?) which in time spoils the plant.

S. adnata has sessile fronds; very hairy. Islands of East Africa.

S. auriculata has firm fronds crowded with leaflets (40 to 50 each side) and about $\frac{3}{4}$ in. broad. Tropical America.

S. braziliensis is very similar to the preceding, except that the fronds bend back on themselves, and so curl up, and stand away from the water.

S. cucullata is so tightly packed with fronds that they almost stand erect instead of floating. India.

S. hastata has sparsely-placed leaflets which lie flat on the water and are covered with short grey hairs. East Madagascar.

S. Hildebrandtii, also from Madagascar, is very green and rough on the upper leaf surface, matted with brown fibres beneath.

S. minima. A Brazilian species very similar to *S. natans*.

S. mollis has leaflets about $\frac{1}{2}$ in. broad and is very hairy. Madagascar.

S. natans is the best-known species and widely distributed throughout the warm temperate regions of the northern hemisphere (excluding America). It bears attractive floating leaflets, bright green above, and the underside matted with shining brown hairs.

S. nigropunctata is similar to *natans*, except that the leaflets are marked with a row of spaced out, blackish dots. East Africa.

S. nymphelluba, from East Africa, has rounded fronds.

S. oblongifolia is similar to *natans*. Amazon Valley and Central Brazil.

S. radula is midway between *natans* and *auriculata*, and bears floating horizontal fronds. British Guiana.

S. Sprucei has crowded fronds with the edges folded together so that they stand up perpendicularly. Amazon Valley.

SESBANIA (Leguminosae) 24 sp. (1 aquatic). From Sesban, an Arabic name.

S. aculeata is a marsh plant growing 3 ft. high, which produces floating roots from the base of the stem covered with spongy aerenchyma. It requires stove treatment and has yellow pea-like flowers and smooth, green leaflets. The plant is an annual. East Indies.

STRATIOTES (Hydrocharidaceae) 1 sp. Name, the Greek for a soldier, from its rigid sword-shaped leaves. Water Soldier.

S. aloides is a curious native plant, in general appearance resembling an aloe. The leaves are borne in rosettes and are long,

narrow and serrated: the flowers are white, male and female being borne on separate plants. It delights to root in the mud of the pond, rising to the surface to flower and sinking to the bottom again when that all-important process is over. It is not a suitable subject for aquarium culture unless constantly renewed.

S. aloides var. *rubrifolia* is a variety of the type with reddish-bronze foliage.

TRAPA (Onagraceae) 8 sp. Name abridged from *Calcitrapa*, from the resemblance of the hornlike projections of the fruit to a dangerous iron instrument used for maiming the legs of cavalry horses, which was known by an old Italian name of Calthrops.

Trapas are annuals with creeping floating stems and triangular, mottled, dentate foliage. They are upheld in the water by swollen petioles, 2 to 4 in. long, generally rosy pink in colour—a characteristic which adds to the general attractiveness of the plant. The flowers are white, small and inconspicuous, but the seeds are about the size of a chestnut, black and hard, with two or four spinescent angles. They contain much farinaceous matter, and in Kashmir form an important article of diet.

T. bicornis with two-horned fruits is extensively used for food in China under the name of Ling. In France they are known as 'Water Chestnuts' and in Italy as 'Jesuit Chestnuts'. Pliny stated that the Thracians made the nuts into bread, and Thunberg that *bicornis* fruits are frequently used in soups in Japan. Culpepper recommends making a poultice of the nuts for use in cases of swellings, sore throats, toothache and inflammations, and suggests that the dried nuts are excellent 'to resist poison and bitings of venomous beasts'.

The seed is bigger than the kernel of a filbert, and comprised of two cotyledons, one large and one small; the large one alone increases in size, the smaller lobe remaining unchanged throughout germination. Trapas are easily cultivated, as it is only necessary to throw the seed into the water and leave it. None of the species are hardy in this country.

T. bispinosa has extremely long petioles to the floating leaves (4 to 6 in.) and the fruit may bear two or four spines. A native of India and Ceylon, it is said to yield large, sweet nuts which are sold under the name of Singhara nuts.

T. incisa comes from Japan.

T. colchica hails from the regions of the Caucasus.

T. Maximowicii is found in parts of Northern Asia.

T. natans is a native of Europe, but becoming very rare and even extinct in some parts. The seeds have four spines and must be kept moist to retain their vitality.

T. verbanensis comes from Lake Maggiore in Italy and has triangular, toothed foliage and two-horned fruits.

WOLFFIA (Lemnaceae) 6 sp. Named in honour of J. F. Wolff who published a work on Lemna in 1801.

W. arrhiza (Rootless Duckweed) is the smallest known flowering plant, being no larger than a pin-head. It is of no beauty and covers the surface of the pool like a green scum.

W. braziliensis, from Brazil, has small flattish fronds dark green in colour, with brown spots. It is densely cellular and like all the Wolffias has no roots.

W. columbiana is the largest of the species and about the same size as duckweed. It comes from North America.

W. floridana has thin minute fronds which grow in masses, several generations cohering—thus forming a dense mass. Florida and Texas.

W. punctata has solitary, thick, green, boat-shaped fronds, pitted with brown cells.

CHAPTER X

Submerged Aquatic Plants

SUBMERGED AQUATIC vegetation is an essential constituent of a perfectly balanced pool or aquarium. If the water is not of crystal clearness, the inhabitants are invisible: the debris of food and animal products turn foul, and the appearance of the pool becomes very unpleasant. Disease spreads among the fish, the water becomes charged with a super-abundance of poisonous gases and the pool is no longer a joy but an abomination. Submerged water plants help to maintain a perfect balance between plant and animal life, and benefit the pond and aquarium in no less than five distinct ways.

Firstly, under the influence of light they are able to liberate oxygen and absorb carbon dioxide, a fact of vital importance to the fish, which, by a kind of chemical balance, do the exact opposite, breathing in oxygen and giving off carbon dioxide. The oxygen dissolved in the water is constantly passing over their gills, and returns to the water with several poisonous gases added. The fish use the oxygen more rapidly than it can be renewed by absorption at the water surface, so that plants are necessary to provide sufficient for their needs. Sometimes, as in bright sunlight, the plants liberate more than the water can take up, and tiny silvery bubbles can be seen rising in a steady stream to the surface. Too much light is, however, not to be recommended, for it generally raises the temperature and warm water has not such a high oxygen content as cold. Of course, this applies more particularly to the aquarium, where a relatively small bulk is under consideration; in the outdoor pool the effect would not be so noticeable.

The second point applies more directly to the aquarium, where the waste products of fish and animal life would have the effect of contaminating the water but for the fact that they are readily absorbed by the plants. These they actually help to fertilise and keep in a good growing condition.

The next point has to do with the important part played by plants in keeping water clear—by shading and by competition.

The pond well stocked with healthy submerged aquatics is generally free from a too abundant growth of algae—one of the aquarist's chief troubles. Suspended microscopic vegetable organisms cause green water, but to thrive they must have abundant light and food. The tremendous competition put up by the larger plants and floating aquatics deprive them of these essentials, so that the water becomes crystal clear.

The fourth point concerns fish breeding. The leaves and stems of submerged and floating plants are the spawning grounds of countless species: whilst their intricate masses afford refuge for the young fry—which thus escape the cannibalistic proclivities of their parents.

Last, but not least, is the fact of their great decorative value, for they form, as it were, a setting for the fish and add much to the beauty and interest of the aquarium. They should be planted in coarse sand, or in a thin layer of loam covered with sand. Shingle, crushed shells and such planting mediums are not to be recommended owing to the ease with which food and other debris can drop between the particles and decompose. In the outdoor pool, sand may be dispensed with, and they can be simply planted in pure loam.

Whilst a few of the underwater plants can be raised from seed, the majority are propagated by means of cuttings. Small slips 2 to 4 in. long can be nipped off between the finger and thumb and planted straightaway into the bedding compost; they will root within a few days.

In the following list of plants the letter *C* denotes cold water subjects, i.e. hardy in this country, and *T* those suitable for tropical temperatures.

ANUBIAS (Araceae) 13 sp. All in West Africa. Etymology doubtful.

A. lanceolata was discovered in 1935 in French Guinea, and makes a good tropical aquarium plant. The leaves, unusually thick and substantial for a submerged plant, are 5 to 6 in. long, about 1½ in. wide, and taper at either end. They keep their rich green colour even in a poor light, and arise from a rhizomatous tuber growing level with or just protruding above the surface of the soil. The flower, a typical aroid, is green at the base, changing to white towards the tip. The plant is best grown in a small pot of loam, top-dressed with aquarium sand. From observations we have made,

the plant would appear to be a calcifuge, so it would be advisable to use soft water. Propagation by divisions of the tuber. *T.*

APIUM (Umbelliferae) 40 sp. An old Latin name, used by Pliny, of uncertain derivation. Marshwort.

A. inundatum (*Helosciadum inundatum*) is a British species often found growing in company with watercress, which plant it somewhat resembles in the aerial foliage. It produces two kinds of leaves, the submerged ones being finely dissected and spread out into bright green fans. Small umbels of white flowers are borne just above the surface. The plant is a poor oxygenator but makes a pretty underwater subject. Europe. *C.*

A. nodiflorum (*Helosciadum nodiflorum*) has dark green hollow stems, watercress-like leaves and axillary umbels of white flowers. It is abundant in ditches and rivulets, and makes a pretty oxygenator for a time, but should be renewed when the foliage commences to lose colour, Britain; Europe. *C.*

APONOGETON (Aponogetonaceae) 30 sp. Three suitable for the aquarium. Name from the Celtic *apon*, water, and the Greek *geiton*, near; from the fact that they grow in water. See also page 87.

A. Bernerianum is a species with skeletonised leaves, not so large and with smaller spaces than in the following species. It is distinct also in that the flower spikes are divided into fours and are of a pinkish colour. South Africa. *T.*

A. fenestrale (*Ouvirandra*) (Madagascar Lace Plant) is perhaps the daintiest and most beautiful of all aquatic plants, but, unfortunately, difficult to grow, for it requires deep, warm, running water—an almost impossible combination in this country. It will, however, thrive fairly well in a tub of water kept in a shady part of the greenhouse, in an even temperature of about 70°. A glass-sided tank is useless; we have never known the plant to flourish in such a receptacle: they inevitably rot away—perhaps the light through the sides is too intense. In Germany, we have seen the plants growing to perfection in total darkness, simply planted in half-barrels, with a lid placed over the top to exclude all light. A good rich loam soil is essential, with the liberal addition of charcoal to ensure sweetness. The leaves are dark olive-green, lying just under the water surface, a mere tracery of nerves and cross veins, which gives them a delicate lacy appearance; occasionally a leaf is found in which the spaces between the veins are wholly or partly filled in with green tissue. When established,

the leaves are as much as 18 in. in length and 2 to 4 in. wide. White flowers are borne on twin spikes 3 or 4 in. out of the water: they are small but thickly crowded on the spikes. The plant sometimes becomes covered with confervae growth, but a few Planorbis snails or one or two tadpoles—which prefer algae to more valuable plants—should quickly clear the leaves. Propagation by seeds and division of the creeping roots. *T*.

A. Henckelianus, also from Madagascar, is allied to *fenestrale* but has a larger rhizome, pale green leaves and is not of creeping habit. It is inferior to that species and less lasting. *T*.

BIDENS (Compositae) 150 sp. (1 heterophyllous water plant, sometimes put in a genus *Megalodonta*, distinct from *Bidens*), so called from *bis*, twice, and *dens*, a tooth, alluding to the seed.

B. Beckii (*Megalodonta Beckii*) (Water Marigold) is a beautiful North American perennial aquatic, with erect or slightly branched stems 2 to 8 ft. in length. The submerged leaves, 1 to 2 in. long, are repeatedly divided into hair-like segments: whilst the aerial foliage is usually in twos or threes and lanceolate in shape. Golden-yellow, marigold-like flowers, 1 to 2 in. across, stand right out of the water. The plant makes an attractive and useful pond subject, but unfortunately is rather scarce. *C*.

BOOTTIA (Hydrocharideae) 20 sp. (Now referred to *Ottelia*, subgen. *Boottia*.) Francis Boott (1792-1863), a specialist on *Carex*.

B. cordata (*Ottelia cordata*) is a hydrophyte with two kinds of foliage; the lower leaves being very short stemmed and entirely submerged, whilst the upper ones are longer and of a floating or aerial character. To the best of our knowledge the genus is not in cultivation, so we are not familiar with the oxygenating properties. Burma. *T*.

CABOMBA (Nymphaeaceae) 6 sp. Derivation not known, but probably a native name in French Guiana. Washington Grass; Fanwort.

Although not hardy, this genus is most desirable in the aquarium, where small slips should be planted in pots hidden from sight with pieces of rock or little hillocks of sand. They prefer lime-free water, and will last six to eight weeks in the tank without soil.

C. aquatica has kidney-shaped floating leaves and coarsely-cut submerged foliage. It bears sulphur-yellow, buttercup-like flowers just above water level. Mexico. *T* or cold-water aquarium.

C. caroliniana is the species most generally grown and has narrow, linear, floating leaves, and coarsely-segmented, fan-shaped underwater foliage. The flowers, half an inch in diameter, are white with two yellow spots at the base of each petal. A very good oxygenator. Florida to Texas, Missouri and North Carolina. *T* or cold-water aquarium.

C. caroliniana var. *pulcherrima*, a fair oxygenator, has reddish-purple stems and narrowly divided dark green foliage. The flowers are bright purple. *T*.

C. caroliniana var. *rosaefolia* is the prettiest form and a real asset to the aquarium. Stems and foliage are of a delightful rosy-red shade, particularly so when the plant is grown in a good light. The variety is more delicate and less easy to propagate than the other forms. It is a fair oxygenator. All the Cabombas may be propagated by means of cuttings. *T* or cold-water aquarium.

Other species, known to exist but not in cultivation, are as follows:

C. australis from South America; *C. furcata* from Brazil; *C. piauiensis* and *C. Warmingii* also from Brazil.

CALLITRICHE (Haloragidaceae) 41 sp. All countries except South Africa. Name derived from the Greek, *kalos*, beautiful, and *thrix*, the hair, in allusion to the attractive style of its growth. Water Starwort.

Possessed of extensive oxygenating powers, the Callitriches also form excellent vegetable diet for aquarium fish, goldfish in particular being very partial to the young succulent leaves. Several species may be found in our native ponds and streams and when gathered abound in minute insects and crustaceans which find shelter in their tangled masses. The plants should always be washed carefully before being placed in aquarium or pond, for fear of introducing harmful aquatic parasites. They are possessed of long, tangled, weedy stems bearing opposite, linear, spiky or oval leaves, and are generally pale green in colour. The submerged foliage is often translucent, but in stagnant water the upper leaves float on the surface in a bright green rosette.

C. antarctica has creeping, rather stout, succulent stems and forms dense mats 2 to 6 in. across. The leaves are fleshy and narrow, about half an inch across with very long petioles. New Zealand. *C.*

C. Austinii is a terrestrial species from North America which



*A garden is a lovesome thing, God wot!
Fringed pool.
Ferned grot—
The veriest school
Of peace!*

T. E. BROWN



A DELIGHTFUL STREAMLET EFFECTIVELY FRINGED WITH WATER-LOVING SUBJECTS



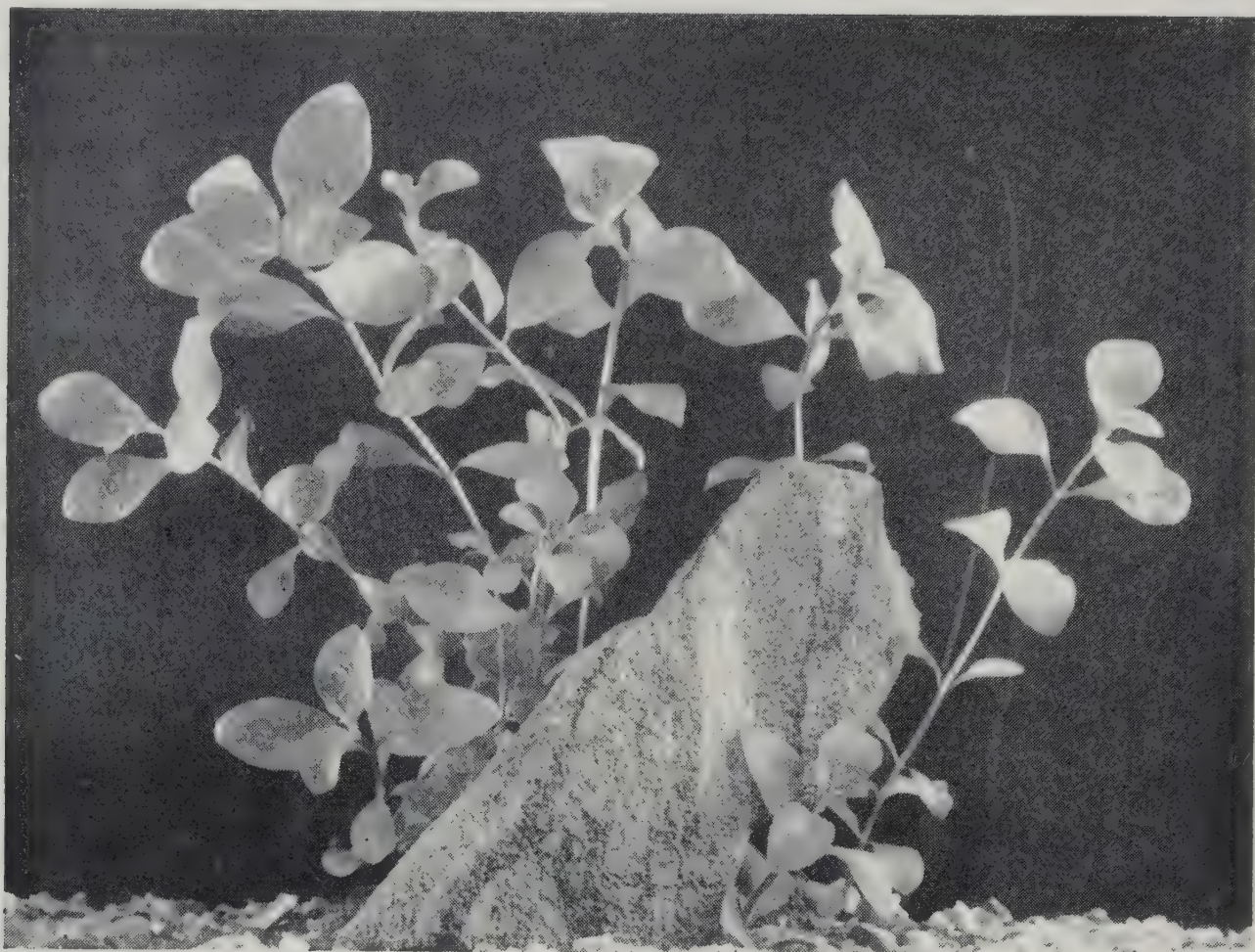
HOSTA GLAUCA (FUNKIA SIEBOLDII)



MYRIOPHYLLUM HIPPUROIDES



VALLISNERIA SPIRALIS, THE TAPE GRASS



LUDWIGIA PALUSTRIS



MYRIOPHYLLUM SPICATUM

prefers to grow in damp shady places at the waterside. It bears erect or decumbent stems, densely clothed with small ovate leaves. The whole plant is fragrant, a feature more noticeable when the stems are dried. *C.*

C. autumnalis (bifida) (Autumnal Starwort) is particularly useful to aquarists during the winter months, for it is one of the few submerged plants active at that time of the year. It is always entirely submerged, with brittle stems and translucent, tiny, dark green foliage. Britain; Europe; North America. *C.*

C. hamulata (Hooked Starwort), though lighter in colour than the preceding, is darker than *C. platycarpa*, which species it much resembles. The fruits are hooked, which constitutes another difference. The plant likes to grow in shallow water or in mud. Britain; Europe. *C.*

C. heteropoda is very similar to *C. verna*, the submerged foliage being narrowly linear and the floating leaves spoon-shaped. North America; Australia. *C* and *T.*

C. Muelleri has filiform stems which are very much branched and interlaced. It forms broad, matted patches with spatulate, tiny leaves. Australia. *T.*

C. Nuttallii bears much-branched, creeping stems thickly clothed with elliptical leaves. It is found growing in wet mud in North America, but will adapt itself very well to the cold-water aquarium. *C.*

C. obtusangula resembles *C. Muelleri* with botanical differences. Europe. *C.*

C. peploides is of prostrate habit and forms wide mats of mossy foliage. It is found in muddy situations in Florida; Texas and North America. *C.*

C. pendunculosa, possibly a variety of *C. hamulata*, is held distinct by Hegelmaier in his *Monographie der Gattung Callitriche*, on account of the fact that it flowers distinctly earlier. The leaves are linear, and it grows in shallow water or wet mud. Britain; North America. *C.*

C. stagnalis (platycarpa) is a good plant for cold-water aquariums but quickly becomes yellow and dies off in warm water. It is similar to *C. verna* with slight botanical differences in the sizes of the fruit. It also prefers shallower water and is in character during the winter months. Britain; Europe; North India. *C.*

C. truncata is often mistaken for *C. autumnalis*, which species

it greatly resembles, slight botanical differences in the fruit constituting the only differences. Italy. *T.*

C. verna (palustris), the commonest species, is at its best during the early spring and summer months: but will continue to grow slowly throughout the winter—several inches of ice on the pond failing to destroy it. It bears long, slender, brittle stems thickly clothed with bright green pairs of leaves which are united at the base. The upper foliage forms small green rosettes floating on the water and is upheld by numerous gland-like bodies on the under-surface. When young, these glands are filled with fluid, but as the plant matures they become charged with air which renders the leaves buoyant enough to float on the surface. The stigmas of the female flowers (in the axils of the uppermost leaves) are now enabled to rise above the water and become ready for pollination. In this respect the function of these glands is similar to the air bladders found in *Utricularia*, or to the intercellular spaces in the leaves of *Brasenia* and other water plants. The plant is only suited to cold-water aquaria, and on account of the rapidity with which it spreads should not be introduced to the outdoor pool. Britain; Europe; Asia; South America; Canada and U.S.A. *C.*

Other species, known to exist but not in cultivation, are as follows:

<i>C. Asagraei</i> , North America.	<i>C. macropterysx</i> , Australia.
<i>C. attenuata</i> , France.	<i>C. marginata</i> , Chili.
<i>C. Berteroniana</i> , Chili.	<i>C. Mandonis</i> , Ecuador.
<i>C. Bolanderi</i> , North America.	<i>C. microcarpa</i> , Cuba.
<i>C. brachycarpa</i> , Australia.	<i>C. occidentalis</i> , Cuba.
<i>C. brevifolia</i> , North America.	<i>C. ovata</i> , North America.
<i>C. capillaris</i> , Italy.	<i>C. plena</i> , North America.
<i>C. cruciata</i> , North America.	<i>C. polymorpha</i> , Scandinavia.
<i>C. cyclocarpa</i> , Australia.	<i>C. sepulta</i> , North America.
<i>C. deflexa</i> , N. America; Australia.	<i>C. Sonderi</i> , Australia.
<i>C. dioica</i> , Italy.	<i>C. spuria</i> , North America.
<i>C. Drummondii</i> , Australia.	<i>C. stenocarpa</i> , California.
<i>C. japonica</i> , Japan.	<i>C. terrestris</i> , North America.
<i>C. latifolia</i> , Portugal.	<i>C. turfosa</i> , Chili.
	<i>C. umbonata</i> , Tasmania.

CARDAMINE (Cruciferae) 100 sp., chiefly temperate. A diminutive of *kardamon*, watercress, a name cited in some early codices

of Dioscorides and applied to a watery herb resembling cardamine.

C. lyrata is a pretty little aquatic for the cold or tropical aquarium, with delicate, pale green, cress-like leaves, and terminal heads of small, 4-petalled white flowers. China; Japan. C.

C. rotundifolia (American Watercress) is a plant of weak, prostrate habit and roots freely at the nodes, bearing alternate, deep green rounded leaves. It makes a good underwater plant for the cold aquarium and bears white flowers. North America. C.

CERATOPHYLLUM (Ceratophyllaceae) 4 sp. From the Greek *ceratos*, a horn, and *phyllon*, a leaf, the foliage being supposed to resemble little horns. Hornwort.

Ceratophyllums are attractive aquatics for the pond or cold-water aquarium, bearing quantities of bristle-like leaves arranged in whorls around the stems. These are sessile, dichotomously dissected into very narrow segments, of a dark green colour and always entirely submerged. Being extremely brittle, they should be handled with care. Propagation is easily effected by breaking off small growing pieces, and setting these in the aquarium compost as cuttings. The plants are good oxygenators and will live quite well for a time without being planted and just floating in the tank, under which conditions they are particularly valuable as sanctuary to young fish fry. We have tried this plant in the high temperatures of a tropical tank and it stands the strain a great deal better than many of our common plants. Hornwort is enabled to flourish at enormous depths. Mrs. Arber says that 'in Iowa, it has been recorded to grow with marked success beneath nearly 30 ft. of water'. In cold weather the apical portions become thickly congested with foliage, and sink to the bottom of the pond as 'winter buds' until the spring.

C. demersum bears rigid, branching stems densely clothed with foliage, growing eight in a whorl and repeatedly forked. It is dark green and may grow 1 to 3 ft. in length according to growing conditions. The flowers are axillary and inconspicuous and the fruit horned. Britain; Europe; North America. C.

C. echinatum has long branching stems thickly clothed with dichotomously dissected foliage, nine to twelve in a whorl. North America. C.

C. muricatum (platycanthum) is very similar to *C. demersum*,

but slight variations in the shape of the fruit account for its being regarded as a distinct species. Asia; Tropical Africa. *C* and *T*.

C. submersum lacks the spiky horns near the base of the fruit which is so characteristic of *C. demersum*. It is also paler in colour and the leaf segments are narrower. Britain; Europe; Tropical Asia; Florida, *C* and *T*.

C. submersum var. *apiculatum* closely resembles the type and only shows botanical differences. It is occasionally found in British waters. *C*.

CHARA (Characeae) 30 sp. From *charis*, grace or beauty. Stonewort.

This family is found growing in stagnant waters in most parts of the world. They make very rapid growth, quickly filling shallow waters with great masses, which decay and become offensive and are reputed, probably erroneously, to cause malaria in many districts, as in the Pontine marshes near Rome. Numerous species of Chara, and in a less degree other water plants (which occur in continuous masses in fresh water), encrust their delicate stems with a coating of lime during the summer months. When these fall and decay, the calcareous deposits are preserved, with the result that the genus performs important geological work and actually builds up rock strata for a future era. That this has occurred throughout the years is obvious by the fact that fossilised fruits have been found over and over again in such lime formations. They thus have a softening effect upon the water.

C. aspera has very slender stems with numerous whorled branchlets of a pale pea-green or greenish-white colour. They grow from 3 in. to a foot in length and are rough and bristly to the touch. A rare British species. *C*.

C. fragifera is a very delicate plant 3 in. to 1 ft. long, of a brilliant green colour. Very rare. Its specific name refers to the red fruiting bodies that render it very ornamental. West Cornwall and Scilly Isles. *C*.

C. fragilis is green, or more rarely greyish-green when lime encrusted, and forms six or ten whorled branchlets on a brittle, usually translucent stem. Britain. *C*.

C. hispida is rough to the touch, being thickly covered with bristly hairs. It is branched and will grow 18 in. in length. Britain. *C*.

C. vulgaris bears ash-coloured, branching stems 12 to 18 in. long. It is very common in some localities in Britain. *C.*

CRYPTOCORYNE (Araceae) 40 sp. Name from *coryne*, meaning hidden club. All natives of Tropical Asia and the Malayan Archipelago. This is a very important genus for the tropical fish fancier, who generally keeps his tanks in a subdued light and so finds the successful maintenance of submerged aquatics rather a problem. Cryptocorynes do best in a shady aquarium: they are plants of great individuality and many tropical fish—especially the Harlequin fish (*Rasbora*), the *Barbus* and *Trichogaster* species—favour the genus for the deposition of their spawn. Unfortunately, reproduction is slow, so they are generally more expensive than other underwater plants. Young stock is sometimes obtained on the Continent by the practice of uprooting adult plants in the late summer and placing them in bowls of water without any soil. After a few weeks a number of young plants appear around the mother crown: these are nipped off and planted in shallow water in loam. Being an aroid, the flowers are borne within spathes standing well out of the water. They are sweetly scented and usually of a reddish-purple colour. Cryptocorynes need warm water, a temperature of 65° F. is the minimum; they favour old still water with a slightly acid reaction. Water Trumpet.

C. Beckettii has narrow, lance-like foliage of a delicate green shade. It is the pygmy of the species, rarely exceeding 7 in. in height. India. *T.*

C. ciliata grows 1 foot in height and has long, thick, narrow-stalked leaves of a uniform green shade. The flowers are fragrant and borne in a long tubular spathe which is fringed at the top. India. *T.*

C. cordata is the species most generally cultivated, and has dull yellowish-green cordate leaves with greenish-purple under-surfaces. The veining is well marked and the whole leaf (3 to 6 in.) has a slightly waved margin. Malay. *T.*

C. elliptica is allied to *C. Griffithii*, but the leaves are smaller and not so cordate. They are roughly 1 to 1½ in. long by ¼ in. wide, fleshy and brown beneath. The flower spathe is white without and black within. India. *T.*

C. Gomezii has long petioled leaves (2 to 3 in. × 1 to 1½ in.) of an ovate to ovate-oblong shape. The spathe tube is narrowed into a long tail. India. *T.*

C. Griffithii grows about 10 in. high, producing narrow, ribbon-like, crinkled leaves, dark green in colour and marked with fine red lines. The flower spathe is purple and stands above the water with the foliage lying under it. Malay. *T.*

C. Nevillii has firm, narrow lanceolate leaves, 1 to 3 in. long $\times \frac{1}{4}$ to $\frac{3}{4}$ in. wide, of a uniform green shade. India; Ceylon. *T.*

C. Mulertii is the tallest of the aquarium species and will grow 12 to 15 in. in height. It has dark green, wavy-edged leaves with a purplish under-surface. *T.*

C. retrospiralis is a slender plant with narrow, almost grass-like leaves and a small spathe (deep green, streaked with purple) terminating in a twist or spiral. *T.*

C. Roxburghii bears narrowly linear foliage, roughly 8 to 12 in. long by $\frac{1}{2}$ to $\frac{3}{4}$ in. wide. India. *T.*

C. Ulsteriana grows 12 to 15 in. high, producing oblong leaves on long petioles and an elongated, purplish-spotted inflorescence. Philippines. *T.*

C. Wightii has slender stems about 4 in. long, with narrow, tapering lanceolate leaves, $\frac{1}{4}$ in. to $\frac{1}{2}$ in. wide, crisply curled at the edges. The young foliage is reddish-brown, passing with age to dark green. India; Malay. *T.*

If the aquarium is in too strong a light for the Cryptocorynes, shade can be obtained by covering the top of the tank with small floating plants, such as Riccia or Salvinia. When setting a new plant do not trim the roots, but spread each one well out, covering them individually with a layer of aquarium compost. Carelessly planted, the roots may rot away—a point we can appreciate after losing stocks on two occasions through this very reason. They will also grow successfully if accorded stove treatment in the same way as are tender Arums.

ECHINODORUS (Alismataceae) 23 sp. See also p. 97.

E. intermedius (Amazon Sword Plant). A Brazilian plant, but recently introduced, which forms a showy display in the tropical aquarium. The leaves are broad and strap-like and of a delightful bright green colour; in some lights they appear translucent. The plant likes a good but not powerful light and increases rapidly by means of runners. Rosy-white flowers and ariel foliage appear if the water is not too deep. *T.*

E. radicans (*Sagittaria guayensis*) is a good oxygenator for the tropical aquaria. The pale green, heart-shaped leaves are large

with the veins showing up prominently against the translucent parenchyma. White flowers and ariel leaves are produced; the growth of the latter can be retarded by keeping the plant in a poor light. The seeds are fertile. Central America. *T*.

EGERIA (Rubiaceae). After *Aegeria*, one of the *Camerae* (Nymphs) in Roman mythology.

E. densa. An excellent aquarium and pond oxygenator well known in the trade as *Elodea densa*. Botanists give the plant distinct generic rank because the small, three-petalled flowers, which appear just above water level, contain nectar and are insect pollinated. The true *Elodea* bear inconspicuous flowers and are fertilised under water.

Under favourable conditions the plant grows several feet in length with branching stems bearing whorls of narrow, linear leaves an inch or so in length. The plant is hardy in England and an excellent pond plant. Argentine. *C*.

E. densa var. *longifolia* has longer leaves than the type. Brazil. *T*.

ELATINE (Elatinaceae) 15 sp. Eight suited to aquarium culture. Name of Greek origin, used by Dioscorides for *Linaria spuria*, later transferred to these plants. Waterwort.

This is a genus of small, creeping aquatics with slightly succulent foliage, few of which attain any height—even under aquarium treatment. They make pretty underwater carpets, persist during the winter and are efficient generators of oxygen. The majority are annuals.

E. Alsinastrum is a robust perennial which grows after the style of *Hippuris vulgaris*. The leaves are sessile and packed tightly together around the stem with inconspicuous axillary flowers. Europe; Japan; Africa. *T*.

E. americana (*Peplis americana*) (Mud-purslane) occurs by the margins of ponds and slow streams in North America, but is often submerged, and may be erect or spreading. The leaves are borne in opposite pairs with tiny, inconspicuous flowers in the axils of each pair. *C*.

E. brachysperma is terrestrial or sometimes submerged and produces tufts of bright green branches 1 to 2 in. in height. North America. *C*.

E. Brochonii is a small robust species with opposite, egg-shaped leaves and terminal yellowish flowers. It is of creeping habit and roots freely. France. *C* and *T*.

E. hexandra (Six-stamened Waterwort) is a rare British species which forms dense mats on the floors of lakes and ponds, although at times found by the damp margins at the waterside. The whole plant is a yellowish-green colour, with branching stems 1 to 3 in. long, rooting freely at the nodes. During periods of drought, when evaporation causes the water to recede, the foliage assumes attractive red tints. The flowers are pink, but small and inconspicuous. Britain; Europe. C.

E. Hydropiper (Octandrous Waterwort) is larger and stouter than the preceding, with minute, opposite leaves and small sessile flowers. Britain; Europe. C.

E. macropoda quickly covers the floor of the aquarium with a mossy green carpet. It bears tiny oval, olive-green leaves and in a good light becomes a very fine oxygenator. Europe; Mediterranean regions. C.

E. triandra bears creeping, much-branched stems, 3 or 4 in. in length, carrying oblong, opposite pairs of foliage. Europe; North America. C.

Other species are:

E. ambigua, North India; Fiji. T. *E. chilensis*, Chili. T.

E. californica, California. T. *E. Lindbergii*, Brazil. T.

E. camphylosperma, Mediter- *E. major*, Europe. C.

ranean regions. C. *E. microphylla*, Peru. T.

ELFOCHARIS (Cyperaceae) 90 sp. Two suitable for the aquarium. Name from the Greek, *helos*, a marsh, and *chairō*, I rejoice—because the genus flourishes in marshes. Spike Rush.

E. acicularis (Hairgrass) is a slender little tufted plant, barely 2 in. high, with needle-like stems, each terminating in a dark brown, oblong spikelet. When grown as a submerged aquatic, the stems may attain 5 or 6 in. and with their attractive appearance and neat growth add much to the beauty of the tank. Propagation is easily effected by division. Britain; Europe; Australia; South America. C.

E. palustris grows in dense tufts, 6 to 12 in. or more in height. The plant is leafless but produces brown spikelets at the tips of the stems. Europe; North America. C.

ELISMA (Alismaceae). 1 sp. Derivation doubtful. Floating Water Plantain.

E. natans is a dainty little aquatic with small, elliptical leaves, barely 1 in. in length, and delicate, white, three-petalled flowers.

In shallow water these lie flat on the surface, covering it with a green and white carpet. The plant is a fair oxygenator. Europe.
C.

ELODEA (Anacharis) (Hydrocharidaceae) 11 sp. From *elodes*, a marsh—the habitat of the plants. This genus includes some of the finest submerged plants we have for oxygenating purposes: in a glass-sided aquarium on a bright day, a steady stream of oxygen bubbles rises to the surface and can readily be observed with the naked eye. The plants also form dense masses of foliage, which are invaluable for goldfish spawning and as shelter for small fry. The rapid spreading powers of one particular species, *E. canadensis*, often from waterways many miles distant, has provided botanists with one of the greatest conundrums of modern times. It is a native of North America and was first introduced to this country in 1847 by Professor Babington, for which reason it is sometimes known as Babington's Curse. Unfortunately, the Curator of the Botanic Gardens at Cambridge, who had received the plant, put several pieces into the River Cam, from which it spread by leaps and bounds to almost every stretch of water capable of supporting aquatic existence. By 1852, the position was serious; rivers were choked, fishing and swimming impossible and barge traffic badly impeded. A government official was sent to advise means of dealing with the menace, but no satisfactory solution was suggested, until suddenly the fertility of the plant began to wane: it appeared to have exhausted itself and became comparatively rare in places where a short time previously it had held sovereign sway. J. D. Siddall, writing on the subject, states that 'the experience of those who have had most to do with it seems to indicate that if left alone its habit is, upon first introduction into a new locality, to spread with alarming rapidity; so much so as literally to choke other water plants out of existence. But this active phase reaches a maximum in from five to seven years, and then gradually declines, until at last the Anacharis (*Elodea*) ceases to be a pest, and becomes an ordinary denizen of the pond, river, or canal, as the case may be'. It can, however, safely be used in the aquarium, the dark green, spiky foliage remaining in character throughout the winter, but should not be introduced to outside waters. As all the Elodeas are apt to grow rather tall, any dead or yellow foliage should be regularly removed, and the young growing shoots nipped off from time to time (about 3 or 4 in. long) and replanted.

E. angustifolia bears slender stems, densely clothed with linear foliage. It is found in slowly-moving streams in Florida. *T.*

E. callitrichoides forms dense masses of pea-green, narrowly divided foliage; small white apetalous flowers float on the surface of the water. Argentine; Australia. *C* and *T.*

E. canadensis (*Anacharis alsinastrum*; *Philotria canadensis*) (Water Thyme; Water Pest; Ditchmoss; Babington's Curse). This species bears brittle stems, thickly clothed with whorls of three or four, minutely serrated, oval leaves. They are light green when young, becoming darker with age. Horses and swans greedily eat the plant when procurable. *C.*

E. crispa. See LAGAROSIPHON.

E. densa. See EGERIA.

E. guianensis is a tender annual species producing white flowers, from Guiana. *T.*

E. linearis is occasionally found in North American swamps. It has slender stems, thickly covered with linear, serrulated leaves, less than 1 in. broad. *C.*

E. minor is a small, slender species with tiny, acute, linear foliage and inconspicuous flowers. North America. *C.*

E. Naias has very slender, almost thread-like stems and leaves. Brazil. *T.*

ERIOCAULON (*Eriocaulaceae*) 250 sp. Name from the Greek, *erion*, wool, and *kaulon*, a stem, from the fact that some have woolly peduncles. Pipewort.

A genus of bog or aquatic plants with fibrous, knotted roots, tufted grass-like leaves and terminal heads of white, grey or nearly black woolly flowers. Their oxygenating powers are negligible yet the plants are often used to clothe the pond margin or for aquarium decoration.

E. compressum bears tufts of narrow, sharply-pointed foliage, with flattened scapes 12 to 36 in. high (according to the depth) protruding above the water. It grows well in a still, shallow pool and makes a good aquarium subject. North America. *C.*

E. decangulare carries long, grass-like leaf-blades and erect flower scapes 1 to 3 ft. tall. It occurs in North American and Cuban swamps, but is rather too large for aquarium treatment. *T.*

E. septangulare has smooth, twisted, seven-angled flower scapes terminating in white woolly heads. The leaves grow in tufts, 1 to 3 in. high. Britain; North America; Europe. *C.*

FONTINALIS (Fontinaleae) 4 sp. Name from *fons*, a fountain—in allusion to the places where it is found growing. Willow Moss.

The water mosses make excellent additions to the aquarium on account of the rich depth of colour and the beautiful seaweed-like tresses of foliage. They usually grow in running water, with the roots attached to wood or stone; it is generally possible to cut away part of this anchorage, and drop it with the plant into a corner of the fish tank. Where this is not practical, each slender piece of stem must be carefully tied with thread to portions of old brick, decaying wood or rough stone. A subdued light should be afforded. The plants are excellent oxygenators, and when gathered in the wild state generally teem with shrimps and small insect life. This makes good fish food, whilst the tangled foliage masses are useful as ova depositories and to shelter small fry. *C* and *T*.

F. antipyretica (Incombustible Water Moss) received its specific name because it was at one time employed by the Swedes to fill up the spaces between their chimneys and walls, and thus, by excluding the air, preventing fire. It is greyish-green in colour, with very long, branched stems, thickly clothed with coarse, three-ranked leaves. The flowers are dioecious and inconspicuous. Britain. *C*.

F. capillacea is very much daintier in appearance, with fine segments of brownish-green foliage. It is found in alpine rivulets, so should thrive in really cold water. *C*.

F. gracilis has lax, dark green masses of stems and foliage which flow like tresses of hair with the movement of the water. Europe. *C*.

F. squamosa (Alpine Water Moss) bears slender, branching stems of olive-green foliage. It is denser and the leaves are much finer than in *F. antipyretica*. Europe. *C*.

HERPESTIS (Bacopa) (Scrophulariaceae). *H. amplexicaulis* and *H. Monnieria*, with fair oxygenating properties, are sometimes used as submerged aquatics in tropical aquaria. For full descriptions, see page 100.

HETERANTHERA (Pontederiaceae) 15 sp. (Two for the aquarium.) Name from *heteros*, variable, and *aner*, an anther, the anthers being variable.

H. graminea (Commelina dubia; Leptanthus gramineus; Heteranthera dubia; Schollera graminea). Water Star-grass.

This pretty little aquatic, which possesses such a wealth of names, is an excellent and easily-grown subject for warm-water

tanks. It is of slender habit, with narrow, linear foliage; and, when permitted, grows in dense masses to a length of several feet. Stems and foliage assume delightful bronze tints when subjected to light; and possess the merit of not attracting algae growth. The star-shaped flowers lie flat on the water and are light yellow in colour. It is a poor generator of oxygen. America. *T.*

H. zosteræfolia in the tropical aquarium forms dense masses of leafy stems, which afford shade and sanctuary to the inmates. The plant somewhat resembles *Egeria densa* and has small, pale blue, axillary flowers. It is a good oxygenator. South America. *T.*

HIPPURIS (Haloragidaceae) 1 sp. From Greek, *hippos*, horse, and *oura*, meaning tail. Mare's Tail; Joint Weed; Cat's Tail; Paddock Pipe; Bottle Brush; Knotgrass.

H. vulgaris. This plant makes an attractive aquarium plant—although a poor oxygenator—up to the time of flowering, when it sinks to the bottom and should be removed. If the roots are planted in pots, the operation is easily effected without undue disturbance to the rest of the tank; in any case it should never be planted in the outside pool without being confined in some sort of receptacle. The stems standing stiffly out of the water and densely packed with whorls of extremely narrow foliage, bear some resemblance to the traditional Noah's Ark Tree. By absorbing a great quantity of inflammable marsh gas, the plant is reputed to be of service in purifying the putrid air in these regions. It is eaten by wild ducks. The flowers, borne in the leaf-axils, are the simplest known in perfect plants: for they produce one stamen, one pistil, no calyx, no corolla and only one seed. Britain; Europe; North America; Australia. *C.*

H. vulgaris var. *tetraphylla* (Four-leaved Mare's Tail). This is a smaller form than the type, growing 4 to 12 in. high, with shorter and broader foliage. North America; Northern Asia. *C.*

HOTTONIA (Primulaceae) 2 sp. Named in honour of Peter Hotton (1648-1709), professor at Leyden. Featherfoil; Water Yarrow; Water Violet; Water Feather.

H. inflata is an entirely submerged aquatic, with spongy, branched stems thickly packed with finely divided foliage. The flower scapes are found several in a cluster; they are very thick, jointed and hollow, and bear white florets at intervals. This plant is rarely seen in Europe; it is in flower from June to August. North America. *C.*

H. palustris is one of the most charming of our native aquatics and a prized acquisition for pool or aquarium. It bears handsome, pinnately-divided foliage and crowded whorls of lilac flowers. These stand 8 to 10 in. above water level and are in flower during the early summer. When planting, each piece should be put in separately, with part of the creeping root attached: carelessly set or packed too tightly the plant fails to establish itself and rots away. Winter buds are formed for the resting season. The plant is a good oxygenator. Britain; Europe. C.

HYDRILLA (Hydrocharidaceae) 1 sp. Name from *hudor*, water, in allusion to the habitation.

H. verticillata somewhat resembles an Elodea, and bears whorls of four, dark green, sessile, stiffish leaves at intervals up the stem. It roots readily from cuttings and is a good oxygenator. Northern India and Ceylon. T.

ILLECEBRUM (Illecebraceae) 2 sp. Used by Pliny for a kind of stone crop; later transferred to this genus. *Illecebra* means enticement. Knot-grass.

I. verticillatum is a pretty little submerged plant, with slender tangled stems of a reddish tint, small, opposite, glaucous leaves and whorls of white flowers. It is quite hardy and an excellent subject for pond or aquarium. Southern Europe. C.

ISOETES (Isoëtaceae) 50 sp. Temp. and Trop. Name from the Greek, *isos*, equal, and *etos*, the year, from its retaining its fronds throughout the year. Quillwort.

An ancient family, forming dense tufts of foliage. Fossil remains have been found as far back as the Lower Cretaceous period in Portugal.

I. Engelmanni is an amphibious species from North America, producing light green, tapering leaves, 12 to 18 in. in length. These grow in dense tufts of from 50 to 100 leaves. C.

I. echinospora has pale green foliage a few inches high. North and Central Europe. C.

I. echinospora var. *Boottii* resembles the type, but is deeper in colour and has smaller macrospores. North America. C.

I. echinospora var. *Braunii* grows 3 to 6 in. high, and produces bundles of soft reddish-green foliage. North America; Labrador. C.

I. echinospora var. *robusta* is much larger than the type, forming thicker tufts and reaching 12 in. or more in height. North America. C.

I. lacustris (Quillwort; Merlin's Grass) is a curious little plant growing at the bottom of mountain lakes, where it has the appearance of a tuft of submerged grass. It bears dark brown, fleshy, globular tubers from which spring olive-green, awl-shaped leaves, 4 to 6 in. in length. Fructification takes place within the dilated bases of these leaves. Fish, and especially carp, will feed upon the foliage: it is said that when brought within the reach of cattle they greedily devour it and that it proves fattening. The plant grows readily in a cold-water aquarium but does not require much heat or light. Britain; Europe; Asia; North America. *C.*

I. malinverniana is a large species with fifty or more bright green, tapering leaves, a foot in height and 1 in. in diameter. Italy. *T.*

I. Tuckermanni bears twenty to thirty very slender, tapering leaves in a close tuft. They are 2 to 3 in. long and very smooth. North America. *C.*

LAGAROSIPHON (Hydrocharidaceae) 10 sp. Name from Greek, *lagaros*, thin, lanky, and *siphon*, tube.

L. major (muscoïdes) (*Elodea crista*). The well-known *Elodea crista* of aquarists has now been referred by botanists to this genus. Difficulties in nomenclature have been caused because the plant so rarely flowers in this country and I have only seen female flowers. We obtained the plant originally in 1906 from Henkel of Darmstadt, who described it as sent to him from Hansen of Klerksdorp, South Africa. The plant resembles a giant *Elodea*, with reflexed foliage arranged in broken whorls up the branching stems. This gives the plant a 'curly' appearance. It is a good oxygenator for all types of aquaria but is not hardy. Africa and Australia. *T.*

L. Roxburghii (*Vallisneria alternifolia*) carries branching stems thickly clothed with alternate grass-like leaves. Male and female flowers are on separate plants as in *Vallisneria*. The plant is employed in India in the preparation of sugar. India; Ceylon. *T.*

The following species are all similar to *Vallisnerias* and but rarely seen in cultivation.

L. cordofanum, Tropical Africa; *L. Schweinfurthii*, Tropical Africa; *L. madagascariensis*, Madagascar; *L. Steudneri*, Tropical Africa; All *T.*

LIMNOPHILA (Scrophularinaceae) 30 sp. Name from *limne*, a pool, and *philos*, dwelling in or loving—from its habitation.

This genus of aquatic or semi-aquatic plants (principally found in Asia and East Indies) makes a valuable addition to the tropical aquarium. They like a rich growing medium, so should be planted in good loam, covered with aquarium sand. Propagation is easily effected by means of cuttings or runners.

The following species, as far as we know, are the only ones in cultivation. The genus is often known as *Ambulia*.

L. conferta is a rather succulent, procumbent plant with sessile, much-serrated foliage, and pretty pink or purple flowers. It will grow either submerged or in pans of loam and water. India. *T.*

L. gratioloides carries two kinds of foliage: the lower leaves finely divided into hair-like segments, and the upper ones pinnatifid. The pale purple flowers somewhat resemble a *Linaria*, and the whole plant emits a resinous smell like that of turpentine. India. *T.*

L. gratissima has linear lanceolate leaves, borne in threes, and purplish flowers. Tropical Asia and Tropical Australia. *T.*

L. heterophylla (*Ambulia heterophylla*) has whorls of finely-cut underwater foliage, and *Ranunculus*-like floating leaves. They are greatly esteemed as food by some fish. Tropical Asia. *T.*

L. racemosa has dense racemes of purplish flowers. It is a small-growing species with erect, stout stems and pinnatifid foliage. India; Malaya. *T.*

L. Roxburghii has quantities of erect stems, carrying oblong serrated leaves and solitary purple flowers. Pacific Islands; Tropical Asia. *T.*

L. sessiliflora is a beautiful shade of vivid bright green, and bears spreading whorls of six to eight dissected leaves at intervals around the stem. Growth is slow, but side branches develop and the plant soon gets a bushy appearance. In wet mud or very shallow water, small bluish-white flowers develop in the axils of the leaves. A temperature round about 70° F., good light and nourishing bedding compost is essential for the plant's success. Tropical Asia. *T.*

LIMOSELLA (*Scrophulariaceae*) 7 sp. Name from *limus*, mud—in allusion to the habitat. Mudweed; Mudwort.

L. aquatica is a small, rare British plant of little horticultural value which increases by means of runners. It produces tiny, long-stalked leaves and several minute white or rose flowers. An annual growing 4 to 5 in. high. Australia; Europe. *C.*

L. aquatica var. *tenuifolia* is similar to the preceding but usually

smaller, the leaves seldom attaining more than $1\frac{1}{2}$ in. in height. They are narrow and grass-like with no distinction between leaf-blade and petiole. Australia; Europe. *C* and *T*.

L. Curdieana is a perennial of stoloniferous habit, with numerous radical leaves, 2 to 5 in. long, of an oval shape, The flowers are crowded at the bases of the petioles, but are minute. Australia. *T*.

LITTORELLA (Plantaginaceae) 3 sp. Name from *litus*, the shore, in allusion to the habitat. Shore-grass; Shore-weed; Rusby and Plantain.

L. americana hails from North America.

L. australis from Chili.

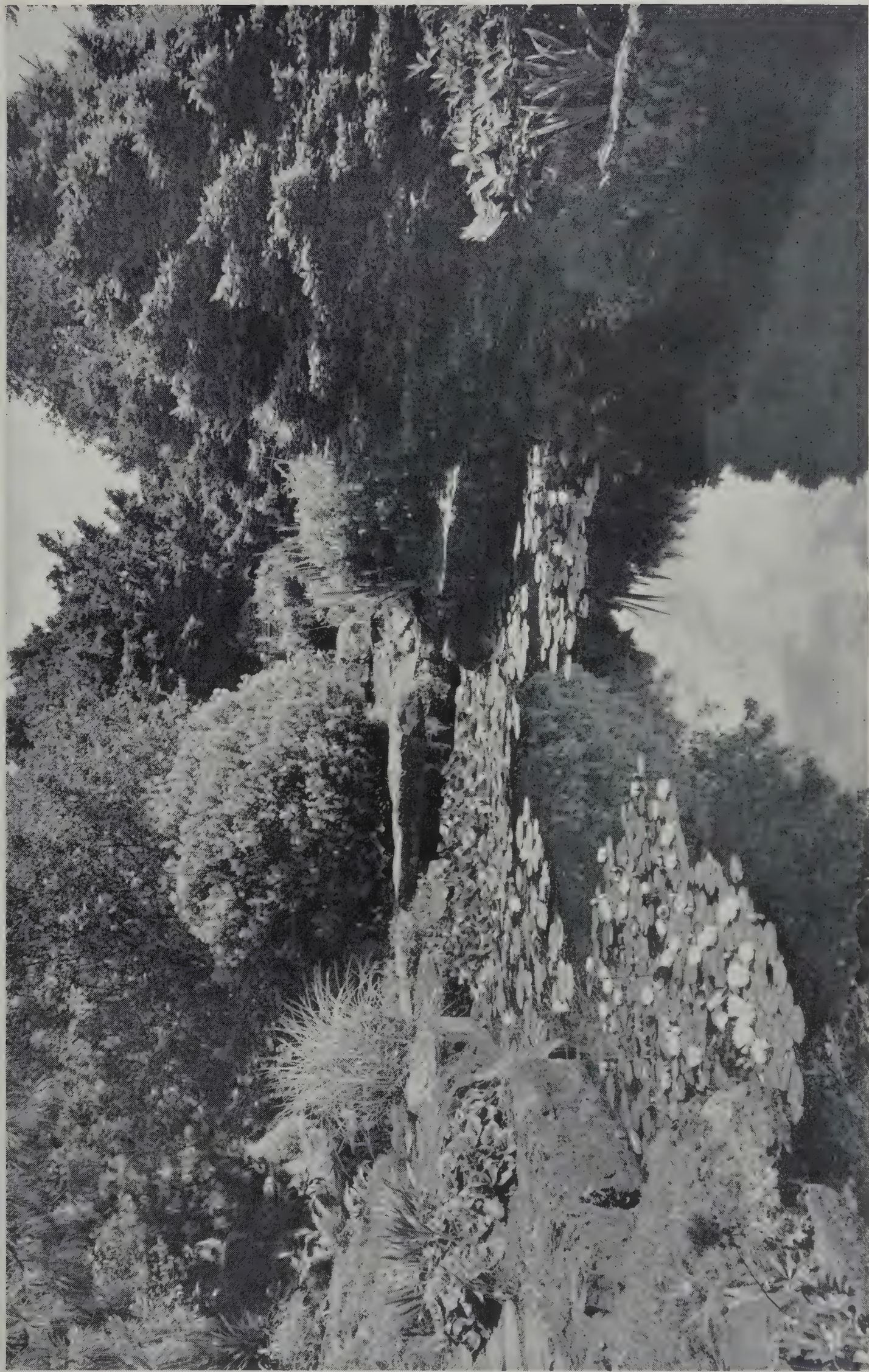
L. uniflora (juncea; lacustris), although a poor oxygenator, is occasionally grown in ponds or cold-water aquariums. It produces tufts of rounded, bright green leaves 2 to 4 in. in height, and throws up solitary, staminate flowers with very long filaments. The fertile flowers are sessile and discovered among the leaves. Britain; Europe. *C*.

LOBELIA (Campanulaceae) 220 sp. (1 aquatic). Named in honour of Matthias de l'Obel (1538-1616), Flemish botanist and physician to James I. See also pages 108 and 268.

L. Dortmanna (Water Lobelia; Water Gladiole) is a beautiful perennial aquatic for cold water, bearing tufts of succulent foliage (somewhat resembling Littorella) 1 to 2 in. in height. It is not readily procurable, being confined to the northern lakes where it grows entirely submerged or in wet, sandy soil. The flowers are borne in loose terminal racemes, well above water level, and are of a beautiful light blue shade. Britain; Europe; North America. *C*.

LUDWIGIA (Onagraceae) 30 sp. 1 British. Named after Kristian Gottlieb Ludwig (1709-1773), professor at Leipsic.

Although more of a bog plant than a submerged aquatic, and useless for aerating purposes, Ludwigia has long been used for aquarium decoration. The foliage is oval, shining and stout of texture, and keeps remarkably free from confervae. In a strong light, the under-surfaces of the leaves assume beautiful reddish tints which contrast agreeably with the more subdued colourings of the true oxygenators. It is easily propagated by cuttings; for best results the plant should be grown in shallow water, in good light and a temperature round about 55° or 60° F. For further remarks and descriptions of the genus, see page 108.



A CLEAR EXPANSE OF WATER ACCENTUATES THE BEAUTIES OF THE LILIES



ONOCLEA SENSIBILIS BY THE WATER'S EDGE



OSMUNDA REGALIS BY THE LAKE AT MYDDELTON HOUSE



A MASSED PLANTING OF MATTEUCCIA (STRUTHIOPTERIS)



A world of leafage, murmurous and a-twinkle.

W. E. HENLEY

FERNS AND SHRUBS BY THE STREAMSIDE



CYPRIPEDIUM PUBESCENS



CYPRIPEDIUM SPECTABILE

LYSIMACHIA (Primulaceae) 120 sp. Four in Britain. Etymology doubtful.

Although not submerged aquatics, *L. Nummularia*, *L. japonica* and *L. Nummularia* var. *aurea* lend themselves very well to aquarium treatment. Small slips, 5 to 6 in. long, should be broken off and pushed into the compost, where they will soon root and provide a pleasing foliage contrast. They are worthless as oxygenators, but will persist for weeks in such situations. For further remarks on the genus, see page 270.

MENTHA (Labiatae) 25 sp. Name, the Latin name of Mint. Although more strictly bog or terrestrial plants, a few of the Menthas and more especially *M. palustris* render great service in the aquarium by their aromatic properties serving to keep the water sweet. They should not be allowed to become weedy or untidy, but ought to be renewed occasionally. For more information on Menthas, see page 111.

MONTIA (Portulacaceae) 1 sp. Named after Giuseppe de Monti (1682-1760), an Italian botanist. Water Blinks.

M. fontana is an unpretentious little plant which generally lives submerged, but, unlike most of its kind, does not collapse during periods of drought. It bears opposite, small elliptical leaves and a few minute white flowers. The whole plant is smooth and rather succulent: it is occasionally eaten in country places as a salad. An annual, it can readily be reproduced by means of seed. Almost world-wide distribution. Australia. C.

MYRIOPHYLLUM (Haloragidaceae) 40 sp. Name from *myrios*, a myriad, and *phyllon*, a leaf—in allusion to the numerous divisions of the foliage. Featherfoil; Water Milfoil.

This genus embraces a group of marsh and aquatic plants of great value to the aquarist, for they are dainty and attractive in appearance, make excellent spawning hosts and are very fair oxygenators. Propagation is easily effected by breaking off small slips, pushing these into the aquarium or pond compost. They will thrive in warm or cold, still or running water but need plenty of light. The plants are glabrous and often bear two kinds of leaves, the submerged ones frequently pinnately divided into capillary segments. The flowers may be axillary, solitary or spiked: they are inconspicuous and monoecious (pistil and stamens in separate flowers on the same plant).

M. alterniflorum is a British species, with verticillate leaves,

3 or 4 in a whorl and shortly segmented. As the lower part of the stem frequently becomes denuded of leaves for a portion of its length, the plant needs constant renewal in the aquarium. Europe; Greenland. *C*.

M. amphibium is a small creeping plant only 3 or 4 in. in length, bearing opposite, entire, oblong leaves. It is quite as much at home on the land as in water. Tasmania. *T*.

M. elatinoides forms dense masses of slender stems, 6 in. to 3 ft. in length—according to the depth of water. The submerged leaves, borne in whorls of four, are deeply pinnatifid. The floral leaves, also in whorls of three or four, are much smaller. It bears white flowers. New Zealand; Australia; Mexico; South Africa; Chile. *T*.

M. Farwellii has whorls of finely-divided foliage, with minute black spines in the axils. The flowers are axillary and purplish. North America. *C*.

M. gracile has all the leaves pinnatifid with very narrow lobes. Australia. *T*.

M. heterophyllum bears foliage of two kinds; the lower leaves divided into hair-like segments and the emerged ones arranged in whorls of three or four. These are linear and sharply serrated. In partial or complete shade the foliage is green, but handsome bronze-red tints are acquired in bright sunlight. North America. *C*.

M. hippuroides bears long, delicate foliage, finely divided into hair-like segments. North and South America. *T*.

M. humile is really a marsh plant but will adapt itself to aquatic conditions. In the terrestrial form it grows 1 to 2 in. high with small, entire foliage, but in water will elongate to 10 or 12 ft., with all or most of the leaves divided into capillary segments. The flowers are purplish. North America. *C* and *T*.

M. integrifolium is a dwarf, slender species with the foliage all entire. Australia. *T*.

M. intermedium (*variaefolium*) is very variable in habit, and in its native habitats forms masses of floating stems, 1 to 4 ft. long, with numerous submerged leaves. In wet ground, however, it only attains an inch or two in height, and the leaves are all linear and entire. The flowers are white. New Zealand; Australia; Malaya; India. *T*.

M. latifolium has emerged lanceolate, serrated leaves, in whorls of three and 1 in. in length. Australia. *T*.

M. laxum is pea-green, carrying tiny ovate emerged leaves and hair-like submerged ones. Florida; North America. *T* or cold-water aquaria.

M. pedunculatum has simple or sparingly branched stems, 1 to 3 in. high, forming broad matted patches. The leaves are minute, entire and rather fleshy. Australia; Tasmania; New Zealand. *T*.

M. proserpinacoides. See page 114.

M. robustum has stout, erect, branching stems, 6 in. to 2 ft. in length. The leaves, five in a whorl, are 1 to 2 in. long and all deeply pectinate. Submerged foliage is rarely seen. The solitary flowers are rather large ($\frac{1}{4}$ in. long) and have petals in the male flowers only. The species is a marsh plant rather than a true aquatic, and covers large areas in New Zealand that become quite dry during the summer. *T*.

M. pinnatum (scabratum) has crowded, reddish-bronze, narrowly-segmented submerged leaves and spikes of small purple flowers. The emerged leaves are linear. It is a good plant for the warm-water aquarium and a fine oxygenator. Tropical and North America.

M. spicatum bears the foliage in whorls of fours. It is an untidy species for the aquarium on account of the tendency of the lower leaves to decay and fall off. Britain; Europe. *C*.

M. tenellum is an unimportant North American species, almost denuded of foliage, with small purplish flowers. It has a rhizomatous rootstock and sends up quantities of sterile stems. *C*.

M. verrucosum has emerged oval leaves and greyish-green pinnatifid ones. Both stems and branches are inclined to be short. Australia. *T*.

M. verticillatum. There are two forms of this milfoil commonly met with in British waters, (*a*) *genuinum* and (*b*) *pectinatum*, the chief difference between them consisting of the fact that *genuinum* bears small greenish flowers for the entire length of its stem, whilst *pectinatum* has spikes of flowers in the upper part only. Britain; Europe; North America; Australia. *C*.

NAJAS (Naiadaceae) 32 sp. Name from *naias*, a water nymph.

These slender, branched, wholly submerged aquatics have fibrous roots, and are so extremely brittle that small strands breaking away cause the plant to spread rapidly. For this reason

they are not to be recommended for the outside pool. They are fair oxygenators and unusual in that they are annuals—a rare occurrence with hydrophytes. The flowers are axillary and quite inconspicuous.

N. flexilis has slender, extremely narrow stems and foliage, the latter being definitely curled and of a light, translucent green shade. Europe; North America. Egypt. C.

N. guadalupensis (microden) bears some resemblance to *N. flexilis* except that the leaves are slightly longer. North and Tropical America; India. T.

N. major (marina) is a larger species, with whorls of leaves borne at intervals on a branching stem. The foliage is so deeply toothed as to have a prickly appearance. Europe; North America. C.

N. minor (gracillima) is even more slender than the preceding species, the stems and foliage being almost threadlike. North America. C.

NASTURTIUM, see RORIPPA.

NITELLA (Characeae) 77 sp. Name from *niteo*, to shine.

This genus is very similar in appearance to Chara, from which it is distinguished by the simple nature of the stem, which consists of a slender tube and not of one spirally striated. It grows very rapidly, forming dense masses rich in oxygenating properties; but, although a good aquarium subject, is not to be recommended for the pond owing to its rampant growth. A large and extensive family, the most easily obtainable species are enumerated below: they are all British.

N. flexilis grows about a foot in length, with branching masses of olive-green transparent foliage. C.

N. gracilis (Chara), of a delightful olive-green shade, is very slender and much branched. C.

N. nidifica (Chara) forms dense, tangled masses. C.

N. opaca (Chara flexilis) is similar to *N. flexilis* with only botanical differences. C.

N. translucens has long-branched, transparent stems, 18 to 24 in. in length. C.

NUPHAR (Nymphaeaceae) 9 sp. Name from *naufar*, or *nylouloufar*, the Arabic name of Nymphaea.

The submerged foliage of certain Nuphars is occasionally used for aquarium decoration. Their oxygenating powers are nil and

the plants can only be used in very large tanks. For further description of the genus, see page 79.

OENANTHE (Umbelliferae) 35 sp. Name from the Greek, *oinos*, wine, and *anthos*, flower, in allusion to the supposed vinous scent of some of the species.

O. Phellandrium, always found in still water, has deeply-cut, divided foliage. The plant is possessed of toxic properties; Linnaeus informs us that horses in Sweden are seized with a kind of palsy after eating it, hence Withering and Sibthorp have named the plant 'horse-bane'. Common in English ponds, it was once employed medicinally and is reputed to have been used in cases of ulcers and cancer and also to have been administered in asthmas and intermittent fevers. Giddiness and other symptoms of narcotic irritant poisoning follow the partaking of the smallest portion of the plants. From these observations it will be realised that the plant should never be grown in the vicinity of stock or cattle, although strangely enough it is a fair oxygenator. Britain. C.

O. Phellandrium var. *fluviatilis* (River Water Dropwort) is a good submerged aquatic for running water, and may also be used in the aquarium for a time. The stem is decumbent and floating, only the flowering portion arising out of the water. The submerged leaves are bipinnate and finely cut into segments—they resemble a very pretty fern. South-east England. C.

OTTELIA (Hydrocharidaceae) 15 sp. Derivation unknown.

O. alismoides (Stratiotes alismoides), an attractive plant rarely grown in this country, is perennial by means of round tubers which throw out fibrous roots. There are several leaves, borne on long petioles: these being entire, ovate to heart-shaped with very pronounced longitudinal ribs. The flower stalks are radical, as long as the leaves, each bearing a solitary white flower of short duration. According to Theophrastus the plant was used medicinally by physicians for fractures. Tropical Asia; Tropical Australia. T.

O. ovalifolia is an interesting aquatic with elliptical leaves, some of which are submerged, the others floating on long petioles or borne above the water surface. The pale yellow flowers are carried aloft in a solitary spathe. Australia. T.

PEPLIS (Lythraceae) 3 sp. Name from the Greek *peplion*, purslane—anciently the name of another genus.

P. Portula (Water Purslane) is a humble aquatic somewhat

resembling but inferior to *Montia fontana*. It has creeping, pinkish stems with small, smooth leaves and axillary inconspicuous flowers. Annual. Britain. C.

PILULARIA (Marsiliaceae) 6 sp. Name from *pilula*, a little pill, in allusion to the shape of the reproductive spore cases.

P. globulifera (Pillwort; Pepper-grass) is a small, creeping plant with grassy leaves, found at the margins of lakes and ponds or occasionally entirely submerged. The bristle-shaped leaves, 1 to 4 in. long, are smooth without and hollow within; curled up in the incipient stage like the fronds of a fern but assuming an erect position with maturity. Fructification consists of small, round globular spore cases—resembling and about the same size as a small pea—found at the base of the leaves. These split when ripe into quarters and remain attached to the plant whilst the spores are scattered. It is a poor oxygenator. Britain. C.

PODOSTEMACEAE is a remarkable family of tufted, or long and ribbon-like, often fleshy aquatics which live only in rushing water and growing on the rocks in rivers. The leaves, but poorly differentiated from the stem, are divided into narrow, hydra-like segments. Tiny flowers devoid of petals are found in the axils of the leaves; these set seed which lie in rock crevices and germinate when the rains swell the rivers. The family comprises some 22 genera and about 100 species; all tropical, the most important being *Rhyncholacis*; *Mourera*; *Podostemon*, *Lawia*; *Dicraea*; *Hydrobryum* and *Castelnavia*. To the best of our knowledge, no attempt has ever been made to cultivate them. Goebel, in the case of a Venezuelan river, describes the bed as quite green with a *Podostemad*, *Marathrum utile*, whilst H. A. Weddell observed *Mourera fluviatilis* in the cataracts of a tributary of the Amazon, growing in such profusion that the rocks beneath the rushing waters were quite hidden by it, and the colour so vivid that the river seemed to 'flow over a carpet of roses'. Further information on the family may be found by J. C. Willis in *Ann. Bot.* vol. xxix, 1915, and *Ann. Peradenija*, 1902.

POTAMOGETON (Potamogetonaceae) 90 sp. Name from the Greek *potamos*, a river, and *geiton*, a neighbour. Pondweeds.

A rather large genus of submerged aquatic plants found in temperate and sometimes tropical regions. The majority are weedy and grow so rapidly as to destroy choicer plants, but a few are suitable for aquaria and ponds. In many of the species

there are two forms of leaves, narrow, often translucent, submerged ones, and broad, floating ones. In still water they often wear a dirty appearance, due to silt stirred up by fish settling on leaves. *P. lucens* effects a deposition of lime within the cell membranes in the same way as *Chara* and *Nitella*, thus acquiring an increased capacity of resistance against the force of the stream. The roots of *P. natans* are said to be eaten in Siberia and form a favourite food of the swan, which hunts them out with tireless vigilance. Ducks will eat the seeds and leaves of *P. crispus* and *P. densus* and in this way spread the plant from one watercourse to another. Most of the genus are very brittle, pellucid and quite smooth; they appear to grow best in a clay subsoil. The few described below are good oxygenators, readily procurable and easily grown. For more information on the genus, see Fryer's *The Genus Potamogeton*.

P. crispus (Curled Pondweed) is a common species with wavy-edged, tapering, almost translucent leaves, 3 to 4 in. long and half an inch wide. They are densely packed on branching stems, and are green in shade, or reddish-brown in a strong light. Bright light shining through the leaves throws a beautiful rosy glow over the surroundings. Britain; Europe. C.

P. densus (Frog's Lettuce) is something like the preceding without the wavy margin, and the foliage is more densely crowded on the stems. Britain; Europe. C.

P. lucens has broad, shining, alternate leaves tightly clasping the stem. Britain. C.

P. natans has two forms of foliage, the upper being elliptical and cellular (very like *Aponogeton*) and 2 to 3 in. in length. The submerged leaves, very narrow, are a foot or more in length—but not always present. Cylindrical spikes of small green flowers are thrust just above water level. The underwater petioles resemble a bamboo stem. The plant is particularly valuable for early spawning fish such as carp and goldfish. Britain. C.

P. obtusifolius bears long, narrow, blunt-edged leaves and inconspicuous axillary flowers. The plant branches freely and grows long and straggling. Britain; Europe; Australia. C.

P. pectinatus (Fennel-leaved Pondweed) has slender, almost hair-like, much-branched stems and foliage. It is a good oxygenator if kept within bounds. The tubers contain starch. Britain; Europe; Australia. C.

P. perfoliatus has alternate leaves, devoid of stalks, tightly clasping the stems. The bronze, practically transparent leaves are a delightful colour and when taken from the water have an almost golden appearance. Britain; Europe; Australia. *C.*

P. pusillus is quite distinct, bearing very narrow, almost thread-like stems and leaves. The loose spikes of brownish flowers are borne above or just below the surface of the water. Britain; Europe; Australia. *C.*

The following forms may also be met with at times in British waters. All are cold-water subjects.

<i>P. acutifolius.</i>	<i>P. nitens.</i>
<i>P. filiformis.</i>	<i>P. pectinatus</i> var. <i>scoparius.</i>
<i>P. flabellatus.</i>	<i>P. plantagineus.</i>
<i>P. heterophyllus.</i>	<i>P. polygonifolius.</i>
<i>P. lanceolatus.</i>	<i>P. prælongus.</i>
<i>P. lonchites.</i>	<i>P. rufescens.</i>
<i>P. longifolius.</i>	<i>P. trichodes.</i>
<i>P. lucens</i> var. <i>decipiens.</i>	<i>P. zosterifolius.</i>
<i>P. mucronatus.</i>	

PROSERPINACA (Haloragidaceae) 4 sp. (All North American.) Name from *proserpo*, to creep. Mermaid Weed.

A group of hardy oxygenating plants which are rarely seen in this country.

P. palustris when well established produces stems 8 to 20 in. long. The floating leaves are nettle-shaped with toothed margins, whilst the submerged foliage is finely cut into stiff, linear segments. Small greenish-white flowers are borne in the axils of the upper leaves. *C.*

P. pectinata is smaller than the preceding and carries no floating foliage, all the leaves being finely pinnatifid with hair-like segments. *C.*

P. platycarpa and *P. intermedia* are given by Small as distinct species with small botanical differences. The former is found in pools in Florida and *intermedia* comes from New Jersey and Georgia. *T.*

RANUNCULUS (Ranunculaceae) 300 sp. (four suitable for the aquarium). Name from the Latin *rana*, a frog, because these plants inhabit the localities favoured by frogs. See pages 117 and 281.

R. aquatilis (Water Crowfoot) is reputed to be almost the only non-poisonous member of its family; horses, hogs and cows will

all feed on it greedily when provided as fodder. The plant is also a good oxygenator, and small slips broken off will quickly root in the aquarium. The leaves are of two types, the lower ones being always submerged and divided into numerous hair-like segments whilst the upper ones float on the surface and are three-lobed. The flowers are white, small and round with yellow stamens. Suitable for swiftly-running streams or bog water. Britain; Europe; North America. C.

R. delphinifolius is an attractive submerged aquatic from North America and quite hardy in the outside pond. The bright green branching stems are thickly clothed with submerged leaves, repeatedly divided into hair-like segments, 1 to 3 in. long; whilst the floating leaves are roughly an inch across, cleft into linear segments. Small yellow flowers star the water. C.

R. divaricatus (*Batrachium divaricatum*) is very similar to *R. trichophyllum* except for the leaves being shorter. Europe; North America. C.

R. trichophyllum (*Batrachium trichophyllum*) bears long, finely-segmented foliage very similar to the underwater leaves of *R. aquatilis*. There are no floating leaves; the flowers are white. North America; Europe; Asia. C.

RORIPPA (Cruciferae) 50 sp. Latinised form of old Saxon name, *Rorippen*.

R. americana (*Nasturtium lacustre*) (Lake Water-cress) has branching stems 1 to 2 ft. long, and submerged foliage 2 to 3 in. in length, finely divided into numerous narrow segments. It makes a graceful and good oxygenating plant. The flowers are white. North America. C.

R. Nasturtium aquaticum (N. officinale) (Common Water-cress) makes a good aquarium plant and affords welcome change of diet to the aquarium inmates; the dark green foliage and small white flowers forming a pleasing contrast to the more feathery submerged leaves of most aquarium plants. It can be propagated by seeds or cuttings. Britain; Europe; North and South America; Asia; New Zealand; Madeira. C.

R. Nasturtium aquaticum var. *variegatum* (N. officinale var. *variegata*). A tiny spring of this plant was found by us in a Hertfordshire stream a few years ago, and with green and white variegated foliage is a great acquisition for the cold-water aquarium. In bright light the young leaves assume beautiful rosy

tints which add to their attractiveness. It is easily propagated by cuttings. *C* and *T*.

SAGITTARIA (Alismaceae) 33 sp. Name from *sagitta*, an arrow.

This genus of aquatics deserves particular attention by the aquarist, for it is perhaps the most useful group of plants at his command. The majority are indispensable for natural planting—where large areas of water are under consideration—and make attractive flowering plants for the small pool. It is in the aquarium, however, that their true worth may be appreciated, for there they thrive and multiply, charging the water with oxygen throughout the entire twelve months. We have more than once observed, when emptying a tank planted with *Sagittaria*, that the sand or soil is still sweet and fresh—not always the case with aquatics—showing that the plant actually helps to purify the soil.

From a botanical point of view also, Sagittarias are of interest owing to the diversity in shape of the foliage. The underwater leaves are narrow and ribbon-like—well adapted to an aquatic existence—and rich in oxygenating powers, whilst the floating leaves have a waxy surface and are broader and more rounded. The aerial foliage is distinct again, being arrow-shaped with long diverging basal lobes. The plants are perennial and increase by means of runners, so that some restrictions must be imposed in the smaller garden. In the autumn, the fat, roundish tubers become packed with food material from the leaves and remain in a bulbous state until the following spring. These tubers contain much amylaceous matter and are eaten by the North American Indians under the name of Wappato; in the raw state they contain a bitter milky juice which the natives expel by boiling. The Chinese and Kalmuk Tartars actually cultivate Sagittarias for food; the tubers preserved in liquid are said to come into the Chinese market at San Francisco. Propagation by division of the runners or seed.

The following forms are suitable for oxygenating purposes in the small pool or aquarium; further references to the genus will be found on page 118.

S. cristata attains a height of 1 to 2½ ft., and bears four or five whorls of flowers above the surface of the water. The oar-shaped leaves are very long-stemmed, spongy and rigid and reduced at the base to mere elliptical blades. The plant is a good oxygenator but rarely obtainable. North America. *C*.

S. cuneata grows 1 to 2 ft. high, with broad, grass-like sub-

merged leaves and a few arrow-shaped ones which float flat upon the surface. The white flowers are borne in whorls of two or three. North America. *C.*

S. cycloptera is very free-flowering and has narrow linear foliage 2 to 6 in. long. North-Eastern America. *T.*

S. filiformis has narrow, grass-like submerged foliage and whorls of white flowers. It is not in cultivation. Central America. *T.*

S. graminea (acutifolia) grows from 4 in. to 2 ft. in height, producing several whorls of small white flowers and narrow, oar-shaped foliage on long flat petioles. Newfoundland. *C.*

S. guayanensis see *Echinodorus radicans*.

S. isoetiformis is a good oxygenator for either cold- or warm-water aquariums. The grassy foliage only grows a few inches in height and the plant produces a single whorl of white flowers. North and Central America.

S. lorata has floating leaves with elliptic or oblong leaf-blades and one or several whorls of white flowers. America. *T.*

S. Möhrrii is a North American species rarely seen in cultivation. It has narrow linear foliage and six to eight whorls of white flowers. *C.*

S. natans (pusilla) is a small-growing plant with slender, simple, grass-like leaves only a few inches in height. It is an excellent oxygenator and one of the best for aquarium work. The flowers are white, borne in a single whorl. The plant varies considerably in different environments, which often leads to confusion as to its correct name. North America. *C.*

S. platyphylla grows 2 to 8 in. high, and has slender foliage with elliptic or ovate leaf-blades. It is not in cultivation. North America. *C.*

S. rigida has variable foliage but is of weak, curving growth. The emerged leaves are hastate and the submerged ones very slender with elliptic blades. North America. *C.*

S. sagittifolia var. *sinensis* greatly resembles *S. natans* but is much larger and stouter in all its parts. *C.*

S. sagittifolia var. *latifolia* is the Duck Potato of North America and a very variable plant, growing from a few inches up to 4 ft. in height. It does well at the pond margin but is also useful for the aquarium. The aerial leaves are broadly sagittate and the flowers white, about an inch in diameter. *C.*

S. subulata is very popular on account of its diminutive foliage,

which rarely exceeds a few inches in height. The dark green, grassy foliage quickly carpets a small aquarium, making excellent cover for young fry. The stronger the light the less height it attains. North America. *C*.

S. subulata var. *gracillima*. Thought by some authorities to be a distinct species, this plant grows 2 to 4 ft. high, which is considerably larger than the type. It is found growing in parts of North America and always entirely submerged. *C*.

S. teres is a dwarf species, only growing an inch or two high, with short, grassy leaves and one or two white flowers. Not in cultivation. America. *T*.

SUBULARIA (Cruciferae) 2 sp. Name from *subula*, an awl—in allusion to the shape of the leaves.

S. aquatica (Awl Wort) superficially resembles a tiny *Juncus*, with miniature, narrow, almost circular leaves an inch or two high. The flowers are small and few, with white petals: they may project to open, or remain submerged and fertilise themselves within the bud. Europe; North America. *C*.

S. monticola hails from Abyssinia. *T*.

TILLAEA (Crassulaceae) 20 sp. (7 aquatic). Named after Michael Angelo Tili, an Italian botanist.

A genus of small, somewhat succulent aquatic or terrestrial plants of annual duration. Generally glabrous, the leaves are opposite, cylindrical and entire, with minute, axillary white or reddish flowers. Pigmy-weed.

T. aquatica grows $\frac{1}{2}$ to 3 in. high, with erect, simple stems and linear, entire, very smooth foliage. It roots freely at the nodes and bears small greenish flowers. Europe; North America; Tropical Africa. *C* and *T*.

T. Helmsii from New Zealand is very similar to the Australian *T. recurva* but not so large. In its native habitat the plant forms large, intricate patches of green and reddish-green stems and leaves. *T*.

T. multicaulis has minute, much-branched, reddish-purple stems of decumbent growth. In water, these become elongated and ascending; the foliage is entire, lanceolate and opposite. New Zealand. *T*.

T. muscosa has minute stems, branched and decumbent at the base and of a reddish hue. The leaves are oblong and bear axillary white flowers tipped with red. Europe; North America. *C*.

T. purpurata of dwarf, decumbent habit bears minute linear leaves of a reddish hue. It is found in wet places in Australia, New Zealand and Tasmania, but would probably grow quite well as a submerged plant. *T.*

T. pusilla has numerous, very slender and delicate stems, 1 to 3 in. in length, the tiny, pale green foliage being borne in distant pairs. New Zealand. *T.*

T. recurva when grown at the pond-side is of creeping or tufted habit, with narrow lanceolate leaves, $\frac{1}{4}$ to 1 in. in length. In deep water, however, the stems become elongated so that eventually masses of stem and leaves float to the surface. A pretty aquarium subject, it is a fair generator of oxygen. Australia. *T* and *C.*

T. Sinclairii is a delicate, creeping plant, rarely exceeding an inch in height unless in water. It has minute green foliage, tiny white flowers and frequently grows in matted clumps. New Zealand. *T.*

UTRICULARIA. The genus makes pretty underwater subjects for cold and tropical aquaria. For full descriptions, see page 206.

VALLISNERIA (Hydrocharidaceae) 5 sp. Named in honour of Antonio Vallisneri, an Italian botanist. Tape Grass; Eel Grass; Ribbon Grass.

Vallisneria is perhaps the most important of all aquarium plants, for it is easily procurable, simple to grow and a free and ready oxygenator. It is also interesting on account of the unusual method of reproduction. Male and female flowers are borne on separate plants, the former consisting of small white buds situated close to the roots. The female flowers are carried at the end of a long spiral stalk, which rises to the surface when ready for pollination. When this occurs, the male flowers break off and rise to the surface, where they open and the pollen fertilises the ovules; after which the spiral stem contracts and the seeds ripen below the water. In North America the plant seeds freely and forms an important grain food for the canvas-backed duck and other wild fowl: it is sometimes called 'Wild Celery' because it imparts a celery-like flavour to the flesh of birds which feed upon it. Our summers, however, would appear insufficiently hot, for we have never known seed produced at the nurseries, or indeed, in this country. The plant also increases by means of runners which can be severed and replanted. Vallisneria grows fairly well in the sand at the bottom of the aquarium, but will do better if there is a layer of loam beneath.

V. americana has rough, pale green foliage irregularly spotted with purple. The older leaves frequently show longitudinal bars of yellow. South America. *T*.

V. spiralis, a first-class oxygenator, produces light green ribbon-like foliage. North America; Europe. Warm and cold aquaria and outdoors in sheltered spots.

V. spiralis var. *gigantea*, an excellent oxygenator, is much larger than the type and in sufficient depth of water will reach 6 ft. in length, with leaves $1\frac{1}{2}$ to 2 in. wide. It is very adaptable, thriving in tropical aquaria kept up to 85°-90° F., and also growing outdoors in sheltered localities. *C* and *T*.

V. spiralis var. *gigantea rubrifolia* has broad, nearly inch-wide leaves, of a glowing bronze-crimson shade with a distinctive red line running down the centre of each. *T* and *C*.

V. spiralis var. *minor* is a very slender, almost transparent variety with thin, grassy leaves. *T* and *C*.

V. spiralis var. *torta*, a pretty aquarium plant, has foliage slightly broader than the type and twisted throughout in a corkscrew manner. The leaves are quite translucent and do not grow as long as *spiralis* true. *T* and *C*.

Other species are:

V. aethiopica (Channel Grass) from tropical Africa. *T*.

V. numidica also from Africa, and *V. Physicum* from Cochin-China. *T*.

ZANNICHELLIA (Potamogetonaceae) 4 sp. Named after J. H. Zannichelli, a Venetian botanist. Horned Pondweed.

Z. palustris is a weedy, submerged aquatic with tangled masses of thread-like stems and small olive-green leaves. It is without beauty and not worth cultivating. The small inconspicuous flowers remain submerged and are pollinated under water. Europe. *C* and *T*.

Other species include *Z. laevis* found in Africa and Australia; *Z. stylaris* favouring the same localities, and *Z. tuberosa* from Cochin-China. All *T*.

CHAPTER XI

Hardy Ferns for the Waterside

Where the copse wood is the greenest,
Where the fountain glistens sheenest,
Where the morning dew lies longest,
There the lady fern grows strongest.

ANON.

THERE IS a rich forest aroma about ferns—an earthy smell, which conjures up visions of shady glades and imparts to the mind a deep sense of peacefulness. It is always a relief to come upon their quiet beauty and refreshing contrast after a pageant of bloom. Relics of a past epoch, their fossil remains date back into the dim ages, and still they flourish, brightening the dark and gloomy spots where nothing else will grow. Quite a number are happiest near to water, so, if at all possible, a portion of the pool-side should be planted with them. The curled Hart's-tongues peeping out beneath the dripping waterfall are a joy throughout the entire twelve months: whilst tall Osmundas, with their feet actually in the pool, are so attractive that one hardly knows which is the more beautiful—the fresh green coat of spring, or the fox-red raiment of autumn.

Most hardy ferns prefer a cool, rich soil, of such a nature as to remain constantly moist without becoming waterlogged; and the best results are invariably obtained by using equal parts of peat, leafmould, loam and sand. Whilst a number will grow in ordinary soil—provided that their wants regarding shade and moisture are respected—ferns should never be planted beneath the fringe of large trees, or near any building from which constant drip may be expected during wet weather. The idea that deep shade is essential is incorrect, for many thrive best in the 'half-light' cast by trees and shrubs, and there are others which will flourish in full sun.

The best time to transplant ferns is during the resting period, between October and March; but by exercising a little care and retaining a ball of soil intact around the roots, they may be moved almost at any time during the year.

ADIANTUM (Polypodiaceae) 70 sp. esp. tropics. From the Greek *adiantos*, meaning dry.

A. pedatum (Hardy Maidenhair) is a very handsome fern, with glistening black stems (about 2 ft. high) and delicate green fronds. It is hardy in a sheltered position but needs a rich vegetable soil. North America; Northern India; China; Japan.

A. pedatum var. *Klondyke*. One of the most beautiful hardy ferns in cultivation. This form was collected by the late Lady de Bathe near Klondyke and sent to the late Mr. Amos Perry, who introduced it into commerce. Umbrella-like fronds of delicate, lacy texture, poised on slender, ebony-black stems, arise from creeping rootstocks. When established, the plant grows about 2½ ft. high, and should be planted in a cool, moist, shady position in a leafy compost.

ATHYRIUM (Polypodiaceae) 120 sp. From the Greek, *athyros*, opened.

A. angustifolium (*Asplenium angustifolium*) (Narrow Leaved Spleenwort) has graceful, green fronds, doubly divided, growing from 1 to 2 ft. in height. It likes a moist, shady position and comes from North America.

A. filix foemina (*Asplenium filix foemina*) (Lady Fern) is one of the prettiest of our native ferns, growing 3 ft. high, with finely-cut, vivid green fronds of fairy-like daintiness. It flourishes best in a moist, shady position. Europe; North America; Russian Asia.

A. filix foemina var. *cristatum* is similar to the type with prettily-crested pinnae.

A. filix foemina var. *percristatum elegans* is a beautiful variety of easy culture, with bold, arching fronds of lace-like texture. It will grow 2½ ft. high.

A. filix foemina var. *polydactylum* has broad, pale green fronds with a conspicuous forked crest, reaching 2-2½ ft. in height.

A. filix foemina var. *pulcherrimum* bears broad, olive-green fronds cut into narrow segments. This is an extremely pretty fern, growing 2-2½ ft. high.

A. filix foemina var. *setigerum cristatum* carries graceful, arching fronds 2 ft. high; the delicately-cut pinnae are bristle-like and delightfully crested.

A. filix foemina var. *Staleyi* is a most desirable and rare British fern, with broad fronds.



SARRACENIA PURPUREA GROWING WILD NEAR BOLTON, MASSACHUSETTS



DROSERA BINATA



BAMBOOS AND FERNS AT COOLHURST



A. filix foemina var. *venonae corymbiferum* has delicate, pale green fronds, with terminal crests and a conspicuous red mid-rib.

BLECHNUM (Polypodiaceae) 220 sp. An old Greek name for some fern.

B. penna marina (*Lomaria alpina*) is a delightful little species from the Antarctic, forming dense carpets of evergreen foliage. The fronds are almost erect, 4 to 6 in. long, dark olive-green, and of bristle-like texture.

B. spicant (*Lomaria*) (Common Hard Fern; Deer Fern) is a very useful plant for damp, shady rockwork but needs a rich, fibrous soil. It is an evergreen species with two kinds of fronds. The fertile ones are erect, 1 to 3 ft. in height, and grow massed together in the centre of the plant, whilst the sterile fronds spread flat, are 18 in. long, and of a deep green colour. Britain; Europe; Japan; Australia; Africa; America; Chile.

CYSTOPTERIS (Polypodiaceae) 5 sp. Alpine and Arctic. Name from the Greek, *kystos*, bladder, and *pteris*, fern.

C. bulbifera (Bladder Fern) has narrow, slender fronds of a pale green colour, on the undersurfaces of which are numbers of inflated buds. These are easily detached and speedily make plants. The midrib is a striking red colour, and the plant grows about 18 in. high. North America.

C. fragilis (Brittle Bladder Fern) only grows 4 to 8 in. high and likes a well-drained, shady position. It will grow in rock fissures near a waterfall. Europe; India; China; North America; Abyssinia; Tasmania; West Indies.

C. montana (Mountain Bladder Fern) is hardy and bears slender, triangular fronds, 4 to 12 in. high, of a vivid green colour. It likes a moist, shady position and is found in the wild state growing amongst sphagnum on ledges of dripping rocks. Northern Europe; North America; Australia.

DENNSTAEDTIA (Polypodiaceae) 60 sp. Named after August Wilhelm Dennstedt, early German botanist.

D. punctilobula (*Dicksonia*) somewhat resembles the Lady Fern, with slender, pale green fronds growing about 2 ft. high. It is a pretty species for sun or shade. North America.

DRYOPTERIS (Polypodiaceae) 1000 sp. Name derived from the Greek, meaning Oak-fern. Many of the genus are incorrectly known as *Lastreas*.

D. aemula (Hay-scented Buckler Fern) will thrive in shady,

rocky positions in the water garden, and bears numerous green fronds—12 to 24 in. high and 5 to 8 in. cross. When handled, the fronds give off a smell of newly-mown hay. Britain; Azores.

D. cristata (Crested Buckler Fern) has erect, deep green fronds, 1 to 3 ft. in height; and may be grown in the bog garden or very damp, peaty soil. Europe; North America.

D. cristata var. *spinulosa* (Spiny Buckler Fern) likes a boggy situation and produces erect, light green fronds, 2 to 3 ft. high. Britain.

D. cristata var. *uliginosa* (Fen Buckler Fern) resembles the type, but the divisions are more copiously toothed. It is a rare British plant.

D. dilatata (Broad Prickly-toothed Buckler Fern) is an easily-grown species requiring no special cultivation. The dark green fronds grow 3 to 6 ft. in height, and are 4 to 18 in. broad. Britain; Europe; North America. Africa.

D. dilatata Boyd's variety is smaller and more graceful than the type, with pale green fronds and blunt pinnae.

D. dilatata var. *cristata* is a very fine variety with dark green, arching fronds, heavily crested. Britain.

D. dilatata var. *grandiceps* needs a moist, partially shady position. It grows 2½ ft. high, bearing heavily-crested, dark green fronds. Britain.

D. filix mas var. *Bollandae*. A very beautiful fern, which forms a most imposing subject when established by the waterside. Growing 2½ ft. high, it bears conspicuous dark green fronds with finely-divided pinnae.

D. filix mas var. *gracilis* is a very graceful variety with broad, pale green fronds, growing 2½ ft. high.

D. filix mas var. *polydactyla* is a very fine subject for planting by the waterside in either sun or shade: and bears erect, deep green fronds, delightfully crested.

D. filix mas var. *propinqua crispa* is one of the most distinct of this section, having broad, overlapping, erect fronds of a deep olive-green colour. It grows 2 ft. high in favoured localities.

D. Goldiana is a useful subject for the bog garden, with pale green fronds which pass to golden-yellow with age. North America.

D. Linnaeana (Polypodium Dryopteris) (Oak Fern) is a very beautiful little fern, growing 9 to 12 in. high, which quickly

carpets the ground. The smooth, bright green fronds are roughly divided into three segments. It likes shady spots and a cool and reasonably moist position. Europe; Africa; U.S.A.

D. Linnaeana var. *plumosum* is a delightful little fern found many years ago near Furness Abbey. If planted in a loose compost it quickly forms dense carpets of delightful, feathery fronds of a soft golden-green shade.

D. oreopteris (*Lastrea montana*) (Mountain Buckler Fern) has fragrant, lemon-scented fronds, 1 to 3 ft. in height and 3 to 12 in. broad: of a refreshing yellowish-green colour. Europe generally; Madeira; Japan; North America.

D. Phegopteris (Beech Fern) will grow in damp situations, especially in the neighbourhood of water and amongst rockwork. The frond is roughly triangular in shape, pale green and somewhat segmented. Europe; North America.

D. Thelypteris (Marsh Buckler Fern) is a most delightful subject to plant near the waterside, for the wiry roots float gracefully on the surface and quickly form most imposing clumps. These branching rootlets form small buds, from which arise slender fronds of lacy texture. Europe; Africa; New Zealand; Russian Asia; North America; China.

MATTEUCCIA (*Polypodiaceae*) 3 sp. Named after C. Matteucci, an Italian physicist.

The genus is frequently incorrectly known as *Onoclea* or *Struthiopteris*.

M. struthiopteris (*Struthiopteris germanica*; *Onoclea struthiopteris*) (Ostrich Feather Fern) is a very graceful plant, with erect, pale green fronds 3 to 4 ft. long, which droop and spread so as to give the plant the appearance of a gigantic shuttlecock. It should be grown in partial or deep shade. North temperate regions.

ONOCLEA (*Polypodiaceae*) 3 sp. From *Onocleia*, the Greek name of a plant.

O. sensibilis (Sensitive Fern). This delightful North American species is one of the most accommodating ferns known to cultivation. It can be grown successfully in a fairly dry, shady spot; but for best results should be planted near the waterside in sun or shade. Here it can ramble over the surface of the water, and quickly spreads into dense carpets. In the famous Thorpe Hall gardens this plant was at one time allowed its freedom, with

the result that it nearly covered a whole lake, forming a most imposing picture.

OSMUNDA (Osmundaceae) 6 sp. Named after Osmund, a Saxon chieftain who hid his daughter from the Danes in a clump of this fern.

O. cinnamomea (Cinnamon Fern) is one of the finest of the genus, growing 3 to 5 ft. in height. The rich green fronds are 6 to 10 in. wide, with the young stems thickly covered with a soft, rusty down. It may be grown in sun or shade so long as its roots are close to water. North America; Mexico; East Indies; South Africa.

O. Claytoniana (Clayton's Flowering Fern) is of a vivid green colour and grows about 3 ft. high. It likes a damp, shady position. North America.

O. decomposita has delicate, pale green fronds, lightly shaded with rosy-red at the base and on the stems. North America.

O. gracilis, a delightful species found in shady woodland swamps in North America and Canada, is totally distinct from any other member of this group; slender branching stems, well clothed with delicate green foliage, grows 3 ft. high and about 3 ft. across. This plant is a real gem for the waterside.

O. regalis (Royal Fern) is undoubtedly the finest fern for planting in close proximity to water. The sterile fronds, growing 4 to 5 ft. high, are a delicate pale green shade in spring; but in autumn they assume deep russet hues—comparable to any of our deciduous trees. In the absence of heavy snow (which breaks the fronds) these may remain in character throughout the winter. The sandy-coloured fertile fronds stand erect from the plant and resemble a *Rheum* inflorescence. Plant it close to the edge of the bank, so that the roots may reach down to the water, and it will increase yearly both in size and beauty. Britain; Europe; Brazil; North America; India; Africa; Australia; New Zealand.

O. regalis var. *crispa* grows only 18 in. high; the fronds have wavy margins.

O. regalis var. *cristata* is a beautiful variety with spreading fronds, each pinna being conspicuously crested. 2½ ft.

O. regalis var. *purpurascens* grows 3 ft. high and has deep purplish stems. It is a very beautiful form and one well worth growing.

O. regalis var. *undulata* bears very broad fronds.

O. spectabilis is a rare and handsome North American species, growing $2\frac{1}{2}$ ft. high. The young fronds are crimson, but change to pale green with maturity.

PHYLLITIS (Polypodiaceae) 10 sp. From the Greek, a leaf, in allusion to the simple foliage.

The genus is more often incorrectly known by its specific name, *Scolopendrium*.

The Hart's-tongue ferns can be planted in shady positions by the waterside, providing that the crowns are not waterlogged. They are evergreen, and may be set in rock crevices or similar niches, beneath waterfalls, bridges or in well-mouths. There are over 800 varieties of the common Hart's-tongue—and with few exceptions they can be grown in moist or wet, shady spots.

P. Scolopendrium (*Scolopendrium vulgare*) (Common Hart's-tongue) has shining, bright green fronds of most elegant and refreshing appearance. Britain; Europe.

P. Scolopendrium var. *crispum* embraces a whole range of forms with curled, frilled and crested foliage; some are twisted like corkscrews and others branched. It is impossible to differentiate between them without going into mathematical details: the interested gardener must see the plants in character.

P. Scolopendrium var. *muricatum* is more curious than pretty. The quaint, strap-shaped fronds are thickly covered with bristle-like protuberances.

P. Scolopendrium var. *muricatum grandiceps*. If a crevice can be found near the waterside, this pretty variety, when established, will make a very imposing picture. The fronds are narrow, with broad, fan-shaped crests slightly incurving, and closely resembling a bird's nest.

P. Scolopendrium var. *nobilis*. This we consider one of the most beautiful hardy ferns in cultivation. It revels in a shady situation near the waterside and, when established, grows 18 to 24 in. across, with broad, arching fronds that are delightfully waved.

P. Scolopendrium var. *ramo-cristatum* is another delightful subject for planting in a crevice near the waterside. Resembling a cabbage lettuce in form, it grows 6 in. high, and bears rosettes of dark green fronds with cockscomb crests.

P. Scolopendrium var. *transversum* is another curiosity. The leaves are deeply divided and cross each other at the apex of each frond.

POLYPODIUM (Polypodiaceae) 400 sp. Name from the Greek, meaning 'many footed' (*pous*, a foot, and *polus*, many).

The Polypodies form an invaluable genus of easily grown, evergreen ferns which revel in shady nooks in moist or wet soil, or in such a position where they may be enveloped in the spray from a waterfall. From creeping rootstocks arise fronds of very varied formation—from deep olive-green to delightful shades of russet-brown. As a general rule, the genus revels in a compost of loam, silver sand and peat moss, incorporated in equal parts.

P. vulgare (Common Polypody; Adder's Fern) delights in a damp situation where there is abundant drainage for the roots. It is suitable for the wild garden, or in a similar position where it may be left undisturbed for many years—and so allowed to take possession. The fronds grow 2 ft. high and are closely packed with orange spore cases: whilst the rhizomes are thickly matted with hairy, brown scales. Britain; Europe; Africa; West and South America.

SCOLOPENDRIUM, see PHYLLITIS.

STRUTHIOPTERIS, see MATTEUCCIA.

WOODWARDIA (Polypodiaceae) 6 sp. Named after Mr. T. J. Woodward, a British botanist.

W. areolata (*angustifolia*) (Chain Fern) likes a wet, swampy soil and grows 12 in. high. Sterile and fertile fronds are distinct, the former being glabrous, pinnatifid and spreading: whilst the fertile foliage stands erect, and is quite entire in the pinnae. North America.

W. virginica is glaucous green and grows 18 to 24 in. high. It is similar to the preceding except for the fertile fronds, which are narrowly divided. Both plants like a wet, swampy soil. North America.

CHAPTER XII

Hardy Bog Orchids

Consider then the orchid's charm
 And suffer none to do him harm.
 He lives in symbiotic state
 With Rhizoctonia for his mate!

ANON.

THERE CAN hardly be a class of plants more neglected, or about which greater ignorance prevails, than the hardy Orchids, and yet the beauty and general garden utility of many render them invaluable for the bog and water garden. The North American and native species will be found most suitable for our uncertain climate, and should be afforded a shady spot where some measure of protection can be provided during inclement weather.

The majority will be found to thrive best in a peaty soil, which a few like well drained, and others prefer of a wet, boggy nature. A small quantity of coarse sand worked into the compost is of great value when transplanting, as it prevents decay and materially assists in the formation of new roots. The tuberous-rooted forms should not be planted deeper than 2 or 3 in. and those with fibrous roots only placed at a shallow depth. Several pieces of rock can be set in position to create more natural effects and to isolate the various kinds; and low-growing plants such as *Sphagnum cymbifolium*, *Mimulus radicans* or *Anagallis tenella* allowed to carpet the ground for the purpose of keeping it in a cool and moist condition.

When cultivating British Orchids attention should be given to the soil and situation where they have been growing, and an effort made to reproduce these natural conditions. Unfortunately, this is not always possible, largely because of the inability to provide the rich nitrogenous soil, which contains the fungi that are essential to their well-being. Knowledge of the presence of fungi in the roots of some Orchids is of comparatively recent date and accounts for the many early failures in growing the plants. Some Orchid roots when lifted are found to be entirely denuded of root hairs—the usual agency through which food is transmitted

—and in their place is a tangled web of fungal filaments. It is believed that the host obtains nitrogenous material from the mycelium of the fungus, which, probably in its turn, makes use of the carbohydrates manufactured by the green tissues of the Orchid. Thus Orchids appear to have become dependent upon fungi for the essential elements of their food supply—an appreciation of which fact may suggest a reason for occasional failures.

The hardy bog Orchids can be transplanted at all stages of growth—even in full flower—provided that a certain amount of the soil and grass surround is moved at the same time. Propagation is at all times slow: possibly due to the intricate and difficult methods of pollination, but very occasionally seed is set in favourable positions.

APLECTRUM (Orchidaceae) 1 sp. Name from the Greek *α*, and *plektron*, meaning without a spur.

A. hyemale (spicatum) (Adam and Eve; Putty-root). An interesting but non-showy genus with but a single species. This has a glabrous stem, 1 to 2 ft. high, carrying about three scales, and a large ovate leaf arising direct from the corm at the side of the flower scape and persisting in winter. The flowers are dull greenish-brown, about an inch long, succeeded by oblong hanging pods. The plant requires to be grown in rich, damp loam. North American swamps.

ARETHUSA (Orchidaceae) 6 sp. Dedicated to the nymph Arethusa.

A. bulbosa is a very charming hardy Orchid, 5 to 10 in. high, bearing one (or rarely two) bright rosy-purple flowers on a glabrous stem. The entire lip is recurved at the apex, with a bold bearded crest down the centre. This handsome Orchid requires a moist, shady spot in a north aspect, and succeeds best in a compost made up of loam, leafmould and sphagnum. It flowers in May and June and hails from peat bogs in Newfoundland.

BLETIA (Orchidaceae) 45 sp. Named after Louis Blet, a Spanish botanist.

This handsome genus succeeds best in a mixture of sandy peat and light loam, with plenty of water during the growing season. A sheet of glass protecting the crowns during the winter saves them from excessive moisture when the bulbs are dormant. They are only suitable for the drier parts of the bog garden.

B. hyacinthina is a Chinese and Japanese species, growing 18 in.

high, with attractive ribbed foliage and slender stems bearing a profusion of deep pink flowers—each up to 2 in. across—in May and June.

B. hyacinthina var. *alba* has narrow, snowdrop-like foliage and slender stems terminating in racemes of pure white, cymbidium-like flowers. It should be grown in a shady position.

CALOPOGON (*Limodorum*) (Orchidaceae) 5 sp. From the Greek *kalos*, and *pogon*, meaning beautiful beard, in allusion to the fringed or bearded lip.

C. pulchellus (*L. tuberosum*) (Grass-pink). This plant requires a moist and shady position and very porous, leafy soil. It should be disturbed as little as possible and is propagated by the offsets from the old tubers. Growing 12 to 18 in. high, it bears a single grass-like basal leaf, and several crimson-purple flowers bearded with yellow, orange and purple hairs at the base of the lip. June and July. North American bogs.

CALYPSO (Orchidaceae) 1 sp. Named after the Greek goddess Calypso, whose name denotes concealment; from its rarity and beauty.

A monotypic genus containing one of the rarest and most delicate of North American orchids. It should be grown in moist, well-drained soil and in a shady position.

C. borealis (*bulbosa*) grows only 3 or 6 in. high and has one rounded leaf about an inch across. Small purple and yellow, cypripedium-like flowers appear in May and June: the lip is larger than the rest of the flower and is hairy within with brown and purple markings. Europe; North America.

CORALLORHIZA (Orchidaceae) 15 sp. Name from the Greek *korallion*, a coral, and *rhiza*, a root, referring to the coral-like roots.

C. innata (Coralroot) is an occupant of sandy or boggy woods in Scotland, North America, North Asia and Northern Europe but difficult to cultivate, for we have never known anyone rear it successfully. Its curious, fleshy, much-forked roots resemble a piece of coral, and the scaly stems bear several drooping yellowish flowers.

CYPRIPEDIUM (Orchidaceae) 30 sp. From *Cypris*, one of Venus' names, and *podion*, a slipper. Lady's Slipper; Venus' Slipper; Moccasin Flower.

This genus comprises the most attractive of the hardy bog orchids: bearing one or several terminal flowers, each with a pair of free lateral sepals and an erect dorsal sepal. The labellum

consists of a rounded pouch—generally brightly coloured—and of a different shade from the sepals. In some species there are two or more radical leaves but others carry the foliage well up the flower stems.

C. arietinum (Ram's Head Lady's Slipper) is one of the smallest of the genus, growing 6 in. high with tiny flowers which, owing to the twisted sepals, bear some resemblance to a ram's head. North America.

C. candidum (White Lady's Slipper) flowers in May and June and bears leafy stems, 6 to 12 in. high. The solitary flower has green and brown spotted sepals and a white labellum striped inside with purple. Bog and swamps, North America.

C. guttatum should be grown in a moist, shady part of the garden in a compost of loam and leafmould. It has two alternate leaves and a white flower heavily blotched with purple. North-West America; Siberia.

C. humile (acaule) (Moccasin Flower; Noah's Ark) is a dwarf species with a large and solitary flower, borne on a stem 8 to 12 in. high. This is of a rosy-purple colour with pale green sepals, and a purple (or very occasionally white) labellum nearly 2 in. long. The plant likes a moist, peaty situation and flowers in May and June. North America; Newfoundland.

C. japonicum has attractive, rounded foliage and leafless scapes carrying one large flower; greenish or silvery-white, spotted with crimson. The plant requires moist, sandy loam and flowers in April and May. Japan.

C. parviflorum carries slender, leafy stems, 1 to 2 ft. high, with oval or lanceolate leaves 2 to 6 in. long. The twisted sepals and petals are longer than the pouch and bright yellow, more or less spotted with brown. The rhizomes and rootlets are employed in medicine for their anti-spasmodic and nervine properties. North America.

C. passerinum is a very rare species occasionally found in sandy Canadian swamps. A slender, leafy stem carries the small flower which has light brown sepals and petals and a white pouch.

C. pubescens (hirsutum) is a beautiful plant with leafy stems, 1 to 2 ft. high, and twisted, yellowish-green sepals and petals striped with purple. The labellum is pale yellow with purple lines. The plant has the same medicinal uses as *C. parviflorum*. Swamps of North America.

C. spectabile (Reginae) is a showy plant with stout stems, 1 to 2 ft. high, which bear elliptical leaves right to the apex. The flowers (one to three) have white sepals and an inflated pouch over one inch long: white again, heavily variegated with rose-crimson stripes. Flowering in June, this handsome plant hails from the tamarisk and cedar swamps of North America.

EPIPACTIS (Orchidaceae) 12 sp. Name from the Greek *epipe-gnuo*, to coagulate—from its supposed effects on milk. The genus requires to be grown in a sunny position just above water level in a loam and leafmould compost.

E. palustris (Marsh Helleborine) is a sturdy plant, growing 18 in. high, with lance-shaped leaves clasping the stem and dirty white flowers streaked with pink or purple. Loamy peat with a calcareous infection will suit the plant well, but it must be kept very moist, especially during the growing season. Northern Asia; North America.

E. Royleana (gigantea) is a stout plant, growing 1 to 2 ft. high, carrying ovate leaves at the base of the scape which tend to become narrowly lanceolate as they ascend. The flowers are greenish-brown veined with purple and borne in spikes. They bloom in June and July and are increased by division. Banks of streams, North America; Himalayas.

GOODYERA (Orchidaceae) 40 sp. After John Goodyer, a British botanist who helped Johnson in his edition of Gerarde's *Herbal*.

Dwarf terrestrial Orchids which are cultivated chiefly for their variegated foliage, and increased by division of the roots.

G. pubescens (Downy Rattlesnake Plantain) has handsome reticulated foliage and slender spikes of white flowers. North America.

G. repens (Creeping Rattlesnake Plantain) has prostrate, ovate, dark green leaves prettily reticulated with white. Slender stems, about 8 in. high, carry several creamy-white flowers. Rare in Britain; Northern Europe; Asia and America.

G. repens var. *ophioides* is the American form of the species, with very well-defined leaf markings.

HABENARIA (Orchidaceae) 400 sp. From the Latin *habena*, a rein or thong, referring to the shape of parts of the flower. The genus is akin to the Orchis, bearing similar foliage and flowers, but differs botanically in the anther cells.

H. bifolia (Butterfly Orchis) has carrot-shaped tubers and angular stems, 12 to 15 in. in length, with two or three broadly ovate leaves at the base. The flowers are white or yellowish-white with a greenish tinge on lip and spur. They are deliciously fragrant, especially after rain. The plant grows well in heavy, damp loam and flowers in June and July. Britain; Europe.

H. blephariglottis has acute, lanceolate leaves alternately clasping the flower scape which terminates in loose spikes of greenish-white flowers. The petals are toothed or somewhat fringed at the apex. July-August. Peat swamps, North America; Newfoundland.

H. ciliaris (Yellow Fringed Orchis) has crowded spikes of brilliant orange flowers with conspicuous capillary fringes. A rare yet beautiful species, it will grow 12 to 30 in. high in wet, sandy places. July-September. North America.

H. cristata flowers in July-August and has small orange flowers, deeply and narrowly fringed in the petals. North American bogs.

H. dilatata (White Bog Orchid) is the species most commonly grown, and has linear leaves and dainty spikes of pure white flowers from June to September. North American bogs.

H. fimbriata (grandiflora) (Large Purple Fringe Orchid) is a robust species, which in its native haunts often reaches 5 ft. high. In this country, however, 1 to 2 ft. is more general, although the individual flowers may be half an inch long and an inch across. The sepal segments are broadly fan-shaped and finely cut at the margins; they are lilac or purplish. Wet meadows, North America.

H. gracilis grows 2 to 3 ft. high, carrying a long, many-flowered spike of greenish blooms. Damp woods in Vancouver and Northern India.

H. herbiola (virescens) (Orchis flava) bears rather stout leafy stems, 1 to 2 ft. long, and crowded spikes of greenish flowers in June and July. Wet swamps, North America.

H. hyperborea (Northern Green Orchid) has stout leafy stems, 1 to 3 ft. high, carrying dense spikes of greenish flowers from May to August. Europe; North America.

H. Hookeriana (Hookeri) has oval or orbicular leaves and naked scapes bearing ten to twenty upright, greenish-yellow flowers in June. Woodland bogs, North America.

H. integra carries elongated leaves which become smaller and

quite bract-like towards the summit of the stem. The spikes, 1 to 3 ft. long, are densely packed with orange-yellow flowers in July. Wet pine swamps, North America.

H. lacera (Ragged Orchis) has lanceolate leaves, 5 to 8 in. long, clasping a slender stem 1 to 2 ft. high. They tend to become smaller towards the top, until the stem terminates in a loose raceme of deeply-fringed, petalled flowers. These are of a greenish-yellow colour and appear in June and July. North American swamps.

H. leucostachys is a tall and stout species with many rather large snow-white flowers in June. Peat swamps, Vancouver.

H. nivea bears leafy stems, 12 to 15 in. high, terminating in spikes of small white flowers. The leaves are linear—almost grass-like—the upper ones being much shorter and passing into the bracts of the spikes. August. Pine bogs, North America.

H. obtusata has slender spikes of greenish-yellow flowers, 4 to 10 in. high. There is one solitary basal leaf. June. North American swamps.

H. peramoena (Fringeless Purple Orchis) grows 12 to 18 in. high, with oblong, ovate leaves and congested spikes of violet-purple flowers in August. Moist meadows, North America.

H. psycodes grows 18 in. or less, with crowded spikes of fragrant flowers which show a great deal of colour variation; white, lilac, rose and crimson are all met with on occasions. Flowering in June and July, it has lanceolate leaves, clasping the flower stem, which tend to become smaller as they ascend. Wet bogs, North America; Newfoundland.

H. rotundifolia (*Orchis rotundifolia*), on slender stems 8 to 10 in. high, carries spikes of small, rose-coloured flowers—each with a white lip. The leaves vary from nearly orbicular to oval and are sheathed below. North America.

H. tridentata (*Orchis tridentata*; *O. clavellata*) (Small Green Wood Orchis) bears basal, oblanceolate leaves and crowded spikes of small, greenish-white flowers. It grows 6 to 12 in. high and flowers from June to August. North America.

LIPARIS (*Leptorchis*) (*Orchidaceae*) 100 sp. Name from the Greek *liparos*, unctuous.

Erect terrestrial or epiphytic orchids with solid bulbs, which are distributed over the warm and temperate regions of the world. Of the two species here described *L. liliifolia* should be planted in

well-drained soil in shade and *L. Loeselii* in a wet situation at the water edge.

L. liliifolia attains 4 to 10 in. in height, and has oval leaves about 5 in. long. The raceme contains numerous showy purple flowers which renders it an attractive subject for the garden.

L. Loeselii, rare British species, has been found in Cambridgeshire bogs. Not as attractive as the former, the flowers are fewer and smaller and of a greenish shade. Europe; North America.

LISTERA (Orchidaceae) 20 sp. Named in honour of Martin Lister, a celebrated English physician and naturalist.

A genus of small orchidaceous plants sometimes cultivated in the bog garden. They should be grown in light, sandy soil with some peat intermixed, and are increased by division.

L. australis, growing 4 to 10 in. high, has loose racemes of minute, yellowish-green flowers striped with purple. It is so small as to be hardly worth growing except by the connoisseur. June. North American bogs.

L. convallarioides (*Epipactis convallarioides*) is found in North American mountain swamps and bears racemes of greenish-yellow flowers, and small, rounded sessile leaves. June-August. North America.

L. cordata (Twayblade) bears sessile, cordate leaves situated half-way up the flower stem. The rather loose racemes are purplish and very minute. June to August. Moist woods, North America and throughout most of the northern temperate hemisphere.

MALAXIS (Orchidaceae) 1 sp. From the Greek *malaxis*, meaning softness, in allusion to the delicate texture.

M. paludosa (Bog Orchis) is the smallest British orchis, growing only 4 in. high, with three or four oval, upright leaves near the base of the stem. The plant is an epiphyte, growing upon sphagnum in bogs and swamps, but may be reared as a terrestrial species. Small greenish-yellow flowers are borne on a loose raceme. The method of fertilisation is most interesting, for which see Darwin's *Fertilisation of Orchids*. Europe; North Asia.

MICROSTYLIS (*Achroanthes*) (Orchidaceae) 150 sp. From *micro*, little, and *stylis*, column, on account of the smallness of the column which contains the anthers and stigma.

M. monophylla (White Adder's Mouth) has slender stems, 4 to 6 in. high, with a single (1 to 2 in. wide) leaf sheathing the stem at

the base. The raceme, thickly covered with small whitish flowers, appears about July. Damp, shady woods and swamps, North America.

M. ophioglossoides (*Achroanthus unifolia*) (Green Adder's Mouth) has an oval or nearly orbicular leaf clasping the stem near the middle, and racemes, 1 to 3 in. long and about 1 in. thick, tightly packed with small greenish flowers. The plant grows from 4 to 10 in. high and flowers in July. Damp woods, North America.

ORCHIS (Orchidaceae) 70 sp. Name, the Greek name of the plant. This group is the typical genus of the great family of Orchids, and of perennial habit by means of simple or palmate tubers. The solitary, erect stems terminate in racemes or spikes of small flowers, which vary considerably in the species: bearing in many cases grotesque resemblances to the animal kingdom. They are all terrestrial and with two North American exceptions native to Europe and Asia. The bog orchis requires rich, leafy soil, which must be moist but not wet, and partial shade.

O. incarnata (Early Marsh Orchis) has large yellowish-green leaves devoid of markings, palmate tubers and flowers which may vary considerably in colour from flesh, pink, pale purple to at times pure white. Europe and the Orient.

O. incarnata var. *pulchella* has rich purple flowers.

O. latifolia (Marsh Orchis) has palmate tubers and a hollow stem, 6 to 24 in. in height. The glaucous-green, lance-shaped foliage is occasionally mottled with brown, whilst the flowers are rose-coloured or purple. Europe.

O. laxiflora (Loose Orchid) is a European plant occasionally found in Guernsey and Jersey, but never in Great Britain. One to three stems, 12 to 18 in. high, carry loose spikes of rich, reddish-purple flowers each nearly an inch across. It should be grown in wet loam and flowers in May and June.

O. maculata (Spotted Orchis) has spreading palmate tubers and lanceolate foliage heavily mottled with dark purple blotches. The flowers, borne in a compact spike, are pale purple or lilac, faintly spotted with white. When grown in good, damp loam this orchid attains a height of 2 to 3 ft. and is generally reckoned our finest native species. The production of seed in *O. maculata* is astounding. Darwin after careful examination of one capsule found it to contain no less than 6,200 seeds, most of which were good. As the same plant usually contains thirty capsules, by this rate of reckon-

ing the total number of seeds from one plant would be 186,000. To show the terrific possibilities in the power of increase in this plant we quote Darwin:

‘An acre of land would hold 174,240 plants, each having a space of six inches square, and this would be just sufficient for their growth; so that, making the fair allowance of 400 bad seeds in each capsule, an acre of land would be thickly clothed by the progeny of a single plant. At the same rate of increase, the grandchildren would cover a space slightly exceeding the island of Anglesey; and the great-grandchildren of a single plant would nearly (in the ratio of 47 to 50) clothe with one uniform green carpet the entire surface of the land throughout the globe.’

The tubers of this species are used in the preparation of Salep, a nutritious diet drink much relished in the East for its stimulating properties, especially for children and convalescents. Culpepper stated that ‘Salep contains the greatest quantity of nourishment in the smallest bulk, and will support the system in privation and during famine; it is good for those who travel long distances and are compelled to endure exposure without food’.

If a plant is lifted from the ground, there will be found two solid tubers, ovate or fasciculated, from which emanate the root fibres which nourish the plant. One of these is destined to be the successor of the other, so that whilst one becomes plump and vigorous the other loses its vitality, becoming emaciated and withered. The former is an offset and from this tuber next year’s shoots will spring, and a fresh offset will be formed. By this means the plant changes its situation about half an inch every year, and as the offset is always produced from the side opposite to the withered tuber, its path of direction eventually takes it right away from the original site.

There are several varieties of *O. maculata*, but these are not generally in cultivation. Britain; Europe; Asia Minor.

O. mascula (Early Purple Orchis) is the earliest and commonest of our native orchids, abounding in damp woodlands and pastures and flowering from April to June. It is a succulent plant with two egg-shaped, solid tubers and oblong leaves (blotched and marked with purple spots) clasping the stem. The flower stalk varies from 6 to 18 in. and bears an erect spike of purple flowers, mottled with darker and lighter shades. The odour of the plant is strong and offensive—especially towards evening. Before coffee was



SCIRPUS ZEBRINUS, PRIMULAS AND IRISES IN HAPPY COMPANIONSHIP
AT THE WATERSIDE



ERIOPHORUM LATIFOLIUM



CYPERUS ALTERNIFOLIUS, THE UMBRELLA GRASS



CYPERUS PAPYRUS, THE EGYPTIAN PAPER GRASS



*Here, free from riot's hated noise,
Be mine, the calmer, purer joys
A friend or book bestows;*

*Far from the storms that shake the great,
Contentments shall fan my seat
And sweeten my repose.*

COWPER



THE WATER GARDEN IN A LONDON BACKYARD



A BOLD PLANTING OF *ASTILBE ARENDsii*



FILIPENDULA PURPUREA (*SPIRAEA PALMATA*)

universally adopted as a breakfast beverage the freshly matured tubers of this species and *O. morio* were used as a substitute, supplies being chiefly imported from Turkey.

O. praetermissa (Common Marsh Orchis) grows in marshy places and often actually in water, bearing stems, 6 to 18 in. high, carrying crimson-purple or reddish flowers. The leaves range in colour from yellowish to bottle-green and are not spotted. Europe.

O. purpurella (Dwarf Marsh Orchis) grows 4 to 6 in. high, with narrow, purple, blotched leaves and purplish-red flowers. Europe.

O. pyramidalis is a very desirable plant which may be readily grown in the drier parts of the bog garden. It favours damp loam to which has been added a quantity of lime or chalk, but is by no means fastidious about the latter. The compact spikes of rich rose or crimson flowers are produced in great profusion and make excellent cut flowers. A. D. Webster in *British Orchids* remarks that 'occasionally the flowers are scented, but, strange to say, this is not always the case'. Europe; North Africa.

POGONIA (Orchidaceae) 5 sp. Name from the Greek *pogon*, a beard, referring to the bearded labellum.

A race of small perennials rarely grown owing to their delicate nature and the care required in planting. The bog sorts need rich, peaty soil which must be moist, not wet. They are best planted in spring.

P. affinis grows 8 to 10 in. high and bears its leaves in whorls of five at the summit—something like *Paris*. There may be one or two greenish-yellow flowers in June. Very rare. North America.

P. divaricata grows 1 to 2 ft. high, bearing one narrow leaf near the middle of the stem and a leaf-like bract close to the flower. The latter is a pretty shade of pale flesh-pink with a purple-veined lip. July. Swamps, North America.

P. ophioglossoides (*Arethusa ophioglossoides*) (Rose Pogonia; Snake-Mouth) can be grown in wet moss or amongst sphagnum. There are one to three ovate or lanceolate leaves on long petioles, and solitary or twin fragrant pale rose flowers. The roots are fibrous. Swamps, North America; Newfoundland; Japan.

P. pendula has three to seven alternate leaves clasping its slender stem, and bears dingy brownish flowers in August. This

very rare plant is sometimes found in the wet woodlands of North America but seldom cultivated.

P. variegata somewhat resembles *P. affinis* but is larger. June. North America.

Saxifraga (*Oxchidaceae*) 5 sp. Mediterranean regions. Named after *Saxa*, a prodigious Egyptian divinity; a name given by Pliny because of the uses of the plant.

A genus of terrestrial orchids with somewhat the habit of *Orchis*. They like plenty of water during the growing season, but need some protection and less moisture during the winter months. The best compost for successful culture is composed of leafmould, loam and sand.

S. corymbosa has narrow green leaves and five-long spikes of purple flowers mottled with lilac and red. Each has a reddish-brown, pendulous lip one inch in length, and flowers in May. Europe; Australia; North Africa.

S. Lingua has smaller flowers than preceding, with less pendulous crimson lips. Europe; Australia.

Saxifraga (*Gynostachys*) (*Oxchidaceae*) 20 sp. From the Greek *spira*, a spiral, and *stachys*, a flower, on account of the disposition of flowers on the spike. Ladies' Tresses.

S. umbellata is one of the rarest of our British orchids, found growing amongst sphagnum moss in bogs. The stem attains 15 in. with radical and stem leaves; white flowers are borne in a single series and arranged spirally. July-August. Europe; North Africa.

S. cernua is very variable in size and foliage and has spikes of fragrant white or yellowish flowers. It grows from 6 to 20 in. high and flowers from August until October. North American examples.

S. graminea (*Gynostachys proserpina*) has spikes of white or yellowish flowers and narrow, grass-like leaves with long sheathing pericels. The spike is usually very twisted and anything from 6 to 24 in. in height. July-August. Wet, grassy places. North America and Mexico.

S. longula (*G. plantaginifolia*) has a glabrous or pubescent stem, 4 to 12 in. high, branched above with spikes of small yellowish flowers. From June till August. Moist stream banks. North America.

S. adnata has a stout stem, 1 to 2 ft. high, with long, spreading basal leaves 8 to 14 in. in length. The flowers are yellowish-white.

and very fragrant, appearing in September and October. North American river banks, often actually in the water.

S. Romanzoffiana has 6 to 15 in. stems and cylindrical spikes of white or greenish flowers in June and July. Bogs in Northern Asia and North America.

CHAPTER XIII

Insectivorous Plants

What's this I hear
About the new carnivora?
Can little plants
Eat bugs and ants
And gnats and flies?
A sort of retrograding!
Surely the fare of flowers is air,
Or sunshine sweet?
They shouldn't eat
Or do aught so degrading.

ANON.

AMONGST THE bog and aquatic plants suitable for the water garden are a number that are insectivorous: that is to say, their foliage is modified and constructed for the capture and retention of small insects, which afterwards serve the captor as sources of nutriment. This unusual process is carried out in various ways—by means of pitchers, bladders or sticky leaves: so that, although possibly only 500 or 600 plants thus seek meat diet, yet the very nature of the various contrivances employed renders the subject full of interest.

The usual enticement offered by these plant carnivores is the shining, nectar-like exudations on the tops of the glandular hairs. The pale green foliage of *Drosera*, glistening with a silvery sheen looks a delightful resting place for a tired and thirsty insect; but no spider's web, spangled with dewdrops on a September morning, is more deceptive, for once he alights, the rest of the hairs—by some sort of telepathic communication—are informed, and bend down over the unfortunate victim until he is powerless to move. Then the glands exude a viscid fluid and all the nutritive parts are dissolved; and being absorbed by the epidermal cells, serve to nourish the plant.

With the North American *Sarracenias*, the modified leaf-structures vary greatly. Some are slender, others broad; they may be green, red, or blotched and striped with vivid reds, purples and greens; and are converted into a long, slender tube,

surmounted by an overlapping 'lid', which acts as a shield against weather conditions. Inside the tube, near the neck, are vast numbers of minute hairs: whilst at the base lie a few drops of shining liquid. The insect is first attracted by the vividly-coloured pitcher and proceeds to explore into the cavity; once in it cannot return, the hairy throat bars the exit, and after frantically fluttering around it eventually falls into the pool of liquid at the bottom, which is potent enough to dissolve the body after decomposition.

The Pitcher plants and Saddle plants of South America have a similar device for the destruction of animal life. Here again we find the modified leaves as vividly-coloured globular pitchers. The nectar-secreting glands near the surface and bright colours lure the victims, who in greedy anticipation scramble forward, find foothold insecure, and tumble down into the liquid secretion at the base.

Utricularias and *Polypompholyx* are furnished with quantities of minute bladders which grow among the leaves, each of which is provided with a tuft of hairs near the mouth that gives them an uncanny resemblance to their commonest prey, the water flea. Into these traps, which only open inwards, the unsuspecting insect swims; there is no exit, it eventually dies, and the decomposed parts are absorbed by the cells lining the inside of the bladder. Small fish fry have been known to be caught by *Utricularia*, and firmly held by the tails.

With a few exceptions, it is wisest to grow the insectivorous plants under glass (in a cool house or a sheltered frame); here their peculiar practices may be studied at leisure, they can be kept constantly moist and afforded some measure of protection from the elements. As a general rule, they revel in a cool, moist, even temperature; and in a compost of one-third part chopped sphagnum moss, one-third sifted loam mixed with a little silver sand, and one-third fern fibre (with the dust shaken out). The planting pans should be half-filled with crocks; the largest pieces at the bottom and graduating upwards, for this ensures good drainage. The plant is then potted, and pieces of live sphagnum inserted as cuttings around it. The pans should be plunged to the rim in damp peat moss, with the spaces between heaped up and planted with live sphagnum. The whole effect is then quite charming, especially if the bank lies close or adjacent to a small indoor pool.

Watering must be carefully done, and only light spraying resorted to: otherwise the pitchers become filled with water and the delicate, filmy surfaces of the *Pinguicula* leaves destroyed. During the hottest days of summer, some shading should be afforded, which is easily done by whitewashing the glass.

Propagation is usually by division, or by seeds sown in live sphagnum moss in pans. The moss must be arranged evenly, and the pans stood in a frame or under a handlight to ensure a cool, moist atmosphere. Occasionally, propagation by means of leaf-cuttings is resorted to, principally with *Dionaea* and *Pinguicula*. The leaves are severed from the parent plant, cleanly and neatly (an uneven edge will not reproduce plantlets), and laid flat on sand in pans, covered with a bell-jar or a sheet of glass to retain the moisture, and stood in a saucer of water. Eventually, when the young plant—with leaf attached—is large enough to handle, it can be potted.

ALDROVANDA (Droseraceae). 1 sp. Europe. Asia.

A. vesiculosa is a rootless, floating plant somewhat resembling *Utricularia*, which, but for its flowers, remains completely submerged. It only flourishes in shade, so should be grown in shallow, lime-free water, amongst reeds or rushes. The leaves grow in whorls, the end of each petiole terminating in several sharp bristles, and a flat, bilobed lamina, something like that of *Dionaea*. These leaf-blades are furnished with glands and 'trigger-hairs', the touching of which by any passing insect results in immediate closure of the two parts. The glands then exude an acid and peptonising digestive ferment which dissolves the softer parts, so that the plant is nourished by animal properties. Winter buds are formed in colder climates; in high temperatures the plant continues to grow, and the leaves are much more sensitive. The flowers are small and inconspicuous.

A. vesiculosa var. *australis* is an Australian form with slightly longer and broader leaves.

A. vesiculosa var. *verticillata*, from Tropical India, has the largest foliage. Propagation is by division.

BYBLIS (Droseraceae) 2 sp. A classical name, after Byblis, daughter of Miletus.

B. gigantea is a beautiful carnivorous plant from Western Australia, which likes to grow in full sun with abundant moisture at the roots. It is a good plan to grow it in peaty loam and stand

the pan in a saucer of water. Reaching 12 to 24 in. high, the root-stock is woody and the stem stout and simply-branched. The leaves, narrow and grass-like, are 6 to 12 in. long with flowers borne on the axils of each. The blooms are solitary, in general appearance somewhat resembling a rosy-purple *Linum*. Stems, foliage, and the backs of the sepals are thickly clothed with purplish, gland-tipped hairs. The plant is free-flowering.

B. liliflora, also from Australia, grows 3 to 4 ft. high and bears blue flowers. The plants are propagated by seeds or divisions.

DARLINGTONIA (*Sarraceniaceae*) 1 sp. Named after Wm. Darlington, an American author and botanist.

D. californica resembles the *Sarracenias* in many points and yet has definite distinctions. The long and tubular pitchers, 1 to 2 ft. in height, are somewhat twisted, and have rounded heads with the top bent over into a fishtail-shaped flap. They are modified leaves and a green colour below, with the upper part mottled in white and the orifice striped with reddish veins. The solitary flowers are inverted, with pale green, hanging sepals and reddish-yellow petals lined with red veins. The plant must be kept constantly moist and is propagated by division of the offshoots. It is not hardy in this country; and is found in Central California by mountain swamps, at an elevation of 2,000 to 8,000 ft.

D. californica var. *rubra* differs from the type by the reddish colour of the pitchers.

DIONAEA (*Droseraceae*) 1 sp. After Dione, a Greek name for Venus. Venus' Fly Trap.

D. muscipula grows wild only in North America, and is found in the vicinity of peat bogs which usually abound in small insect life. Darwin described it as one of the most wonderful plants in the world, and gave a most interesting account of its carnivorous propensities in his well-known book *Insectivorous Plants*. It may be grown outdoors in sheltered parts of the country, but is more easily looked after in the greenhouse. The leaves, four or eight in number, are arranged in a spreading rosette—each leaf consisting of a stalk and a blade. The stalk or petiole is flat and expanded, whilst the blade consists of a roundish, flat, bilobed plate with a contractile midrib. The edges of the leaves are bordered by stiff, tooth-like hairs which interlock when the halves close; whilst each side bears three sensitive 'trigger-hairs', arranged in a

triangular manner on its upper surface. Numbers of sessile glands, usually of a crimson colour, cover the rest of the surface and render it attractive to insects, which are thus lured into contact with the 'trigger-hairs'. A single touch, strangely enough, does not cause the leaf to close, but a second—or the brushing of two adjacent hairs—at once causes the two parts of the leaf to fold over. The plant delights in full sunshine and a very humid atmosphere—in shade the leaves become a uniform shade of pale green. White flowers appear about June or July, but should be removed, as they are apt to weaken the plant.

DROSER (Droseraceae) 90 sp. From the Greek, *droseros*, meaning dewy, in reference to the dew-like exudations on the tips of the leaf-hairs. Sundew; Dew Plant; Rosa-solis; Youth Wort. The *Droseras* embrace a large number of insectivorous plants, found growing in muddy soil, boggy situations or at times even in the water itself. The Australian forms may produce rhizomatous tubers—nature's provision to enable them successfully to withstand periods of drought. The foliage is generally thickly covered with glandular hairs, exuding a natural, colourless, viscid fluid. These hairs have the power of movement, and bend over and hopelessly entangle any stray insect which comes into contact with them. The victim being held helplessly captive, the fluid becomes acid and emits a peptinaceous ferment which completely dissolves all the softer tissues. The juices so obtained serve to nourish the plant. The scapes end in curved cymes of variously-coloured flowers and appear during the early summer months. *Droseras* should be kept constantly moist, and in a light place. They may be propagated by division, seeds, or from half to one-inch cuttings taken from the slender tubers. The plants yield a purple dye, and the liquids *rosoglio* and *aqua-auri* are said to contain *Drosera rotundifolia* as an essential ingredient.

D. acaulis from South Africa produces rosettes of glandular foliage and scapes, about 3 in. high, bearing white flowers. Australia and South Africa.

D. anglica is a native species with rosy-white flowers. Britain; Europe and North America.

D. arcturi has rather large white flowers and crowded foliage. Australia and New Zealand.

D. auriculata bears erect, leafy stems 6 to 18 in. high, but sometimes longer and almost climbing. The radical foliage is

round, densely glandular, and emanates from a thickish tuber buried deeply in the ground. The inflorescence is a raceme of six or eight pink or purple flowers. New Zealand and Australia.

D. binata (dichotoma) bears long, slender, forked leaves, 12 to 15 in. long, arising from an erect stem carrying pretty white flowers. The foliage is thickly covered throughout with reddish-green viscid hairs. Australia; New Zealand.

D. binata var. *rubra* has foliage more repeatedly forked than the type and is covered with crimson glandular hairs.

D. Birkeana is found in Australia and South Africa. We have never seen the plant and do not know its colour.

D. brevifolia bears small foliage and several scapes of dainty white flowers. North America.

D. Burmanni is an Australian species.

D. capensis (Cape Sundew) bears semi-erect leaves in a rosette. They are linear and densely covered with purplish hairs. The flower stems, 6 to 10 in. in length, bear about a dozen purple flowers. Africa; Australia.

D. capillaris has spoon-shaped foliage, 1 to 2 in. long, thickly covered with glandular hairs. The flowers are pink. This plant will actually grow right in the water. North America.

D. cistiflora, from South Africa, bears large, open, scarlet flowers about 2 in. in diameter. Africa; Australia.

D. erythrorhiza hails from Australia and has white flowers.

D. filicaulis, also from Australia, has very narrow, fragile foliage thickly covered with hairs; the scapes grow about 6 in. high and bear purplish-red blooms.

D. filiformis (Thread-leaved Sundew) has long, narrow leaves 10 to 12 in. in length, with no distinction between leaf-blade and petiole. They are glandular (with purplish hairs) throughout. The flowers are rosy-purple and very free. North America.

D. gigantea has white flowers. Australia.

D. glanduligera is a dwarf species from Australia with orange-red flowers. It is also found in parts of New Zealand.

D. indica (Indian Sundew) is of scrambling, prostrate habit with white or pink flowers. Australia.

D. intermedia will grow actually in the water and bears slender rhizomes, 1 to 4 in. in length. The scape is erect, 6 to 8 in. long, with white flowers; the foliage, spoon-shaped, 1 to 3 in. in length. Northern Europe; West Indies; North America.

D. linearis bears extremely narrow, glandular foliage, with long erect petioles and stray white flowers. North America.

D. longifolia is somewhat similar to *intermedia* except that the foliage is erect. Flowers white. Britain; Northern Europe; North America; Asia; Newfoundland.

D. longifolia var. *americana* grows about 3 in. high with white flowers.

D. macrantha is an Australian form with large rose flowers.

D. macrophylla has white flowers and long, slender leaves. Australia.

D. Menziesii has rather large pink or white flowers and climbing or twisting stems. Australia.

D. pallida bears white flowers. Australia.

D. pauciflora has pale green rosettes of foliage and a few stray white flowers. South Africa.

D. peltata is a very beautiful species, forming radical rosettes of kidney-shaped leaves, from which emanate erect stems, 6 to 10 in. in height. Small, rounded leaves are borne alternately up the stem, which branches at the apex into sprays of white or rosy pink flowers. All parts of the plant, excluding the petals, are thickly covered with red glandular hairs. Australia.

D. pygmaea is a minute form which makes neat rosettes one-third to one half-inch in diameter. Large stipules form a beautiful silvery cone in the centre; the flowers are white. Australia.

D. ramentacea (madagascariensis) has flat rosettes of foliage and produces stolons. South Africa; Australia.

D. rotundifolia is our commonest native species, often met with in boggy situations in the New Forest. It bears small rosettes of round leaves and cymes of white flowers. Winter bud rosettes are formed in the autumn (as with some aquatic plants) to carry the plant over to the following spring. Europe; Asia; North America.

D. spathulata bears small rosettes crowded with foliage and scapes of white or rose flowers. Australia; New Zealand.

D. stenopetala bears slender, long-stalked leaves, 1 to 4 in. in length, and five or six scapes, each bearing a solitary white flower. New Zealand.

D. stolonifera is an Australian species with white flowers, which is reproduced by means of stolons.

D. Tracyi with the habit of *filiformis* has pale green leaves, 12 to 18 in. in length, and grows about 2 ft. high. The flowers are

purple and about three-quarters of an inch across. This species is one of the largest of the genus. North America.

D. violacea has violet flowers. South Africa; Australia.

D. Whittakerii, with white flowers, comes from Australia.

D. Whittakerii var. *flore pleno* has double flowers.

DROSOPHYLLUM (Droseraceae) 1 sp. From *droseros*, dewy, and *phyllum*, a leaf, in allusion to the glands on the leaves.

D. lusitanicum (Portuguese Yellow Sundew) is a dainty little plant, almost shrubby in appearance owing to the woody stem, 2 to 3 in. high at the base; which is about half an inch in diameter with the accumulated remains of old leaf-bases. From the apex of this arises the foliage—4 to 8 in. in length and one-eighth inch broad. The flower stem grows about 12 in., it is leafy and bears a corymb of bright yellow flowers, an inch and a half across. Stems, foliage and sepals are thickly covered with purplish, viscid hairs, which, however, are not mobile as in the *Droseras*. The Portuguese make practical use of this plant by hanging it up in their houses, as we do fly papers. It likes to be kept dry.

GENLISEA (Lentibulariaceae) 11 sp. This remarkable genus of aquatic carnivores is akin to the *Utricularias*, but with very long necks to the bladders, and differs in other botanical details. The stems are green and the bladders transparent. The plants are distributed throughout various parts of the world, but are too seldom obtainable to have any practical value in the water garden.

G. africana comes from South Africa.

G. aurea is found in Brazil.

G. filiformis is also from Brazil.

G. luteo-viridis hails from Cuba.

Genliseas minor, *ornata*, *pusilla*, *pygmaea*, *reflexa*, *repens* and *violacea* are all from Brazil.

HELIAMPHORA (Sarraceniaceae) 1 sp. Greek compound from *helios*, the sun, and *amphora*, a pitcher, meaning a sun-pitcher.

H. nutans. This strange plant was first discovered about 1839, by the brothers Schomburgk, on the borders of British Guiana; and was afterwards re-discovered in 1841 by Burke, the orchid collector, who sent plants to England. It bears radical pitchers with very wide, funnelled mouths, and a tiny rudimentary lid terminating the midrib. The flowers are borne singly or several together on a slender stem 1 to 2 ft. long; they are white or pale rose with yellow stamens.

Nepenthes and *Cephalotus* are genera of tropical insectivorous plants only suited to stove treatment. They hardly need bog conditions so have therefore been omitted from this book, but some account of them may be found in Goebel's *Pflanzenbiol.* and Macfarlane in *Ann. of Botany*, vols. iii and vii.

PINGUICULA (Lentibulariaceae) 32 sp. Name from the Latin, *pinguis*, fat, in allusion to the greasy feeling of the leaves. Bean-weed; Sheep Root or Rot; Rot Grass; Sheep Weed; Sheep or Earning Grass (the latter name from its use in curdling milk); Butterwort; Bog Violet.

The Pinguiculas are graceful little bog plants with pale green rosettes of succulent and greasy foliage, and pretty, long-spurred flowers, something like a snapdragon. They need plenty of sunshine and moisture but should not be sprayed; in winter they can be placed in a cool house to rest. Propagation is by means of seed, division or leaf-cuttings.

The leaf-glands secrete an acid digestive fluid, which desroys the tissues of any animal captured by them. This peptonising ferment is very similar in its action to albuminous substances, as is the rennet in animal stomachs: a fact which has been appreciated by the Lapps for centuries, for they use the foliage to curdle their milk. The warm milk, straight from the reindeer cow, is poured over Pinguicula leaves, and forms a tenacious mass which is eaten spread on bread. The Lapps call the substance Tåtmiölk: it has the power of imparting its properties, so that a small piece broken off and thrown into fresh milk converts that too into Tåtmiölk. Danish peasant girls are also said to use the juice of the leaves as a hair pomade.

P. alpina is a European species, with pale green leaves and nodding white flowers. It grows about 3 or 4 in. high.

P. caudata, when young, bears long, narrow leaves in flat rosettes, but as the plant ages they become larger and obovate in shape. The flowers are borne singly on slender 6 in. stems: they are rosy-carmine and have a pale pink throat. Mexico.

P. caudata var. *Rosei* is similar to the type, but with deep violet flowers, 2 in. across. Mexico.

P. caudata var. *superba* has rich rosy-carmine flowers about 2 in. in diameter. William Watson records that *caudata* is largely grown by orchid fanciers for the purpose of catching a small midge which finds its way into the houses and lays its eggs in orchid seedlings.

P. edentula grows about 6 in. high, with hairy stems and yellow flowers. It is native to North America.

P. elatior, also from North America, grows 12 in. tall, bearing purplish-white flowers about three-quarters of an inch across. The foliage is light green and borne in a rosette of about 5 in. diameter.

P. grandiflora, a species native to Ireland, grows 5 to 6 in. high, carrying single flowers, deep violet in colour with an occasional white spot. Europe.

P. gypsicola grows 3 to 4 in. high, carrying deep purple flowers with a conspicuous white tube. When the plant is in flower the foliage is long and narrow, very hairy on the upper surface; but during the resting period, it forms a neat rosette and is more spoon-shaped. Mexico.

P. hirtiflora is distinguished from *grandiflora* by the throat, which is yellow within and white without. Europe.

P. hirtiflora var. *alba* has white flowers.

P. lusitanica is a British species with pale lilac flowers raised about 6 in. from the ground. The foliage is most attractive, being quite translucent, so that the red veins are plainly visible.

P. lutea has yellow, bearded flowers with curved spurs, splashed at the throat with red. Small, oval leaves grow in a rough rosette. North America.

P. planifolia comes from Florida, where it is found growing in shallow water. The flowers are purple varying to white, 1 to 4 in. in length.

P. pumila has rosettes of pubescent foliage, half to one inch in length: and small lilac flowers. North America.

P. vallisneriaefolia has narrow, ribbon foliage and scapes 6 in. high bearing lilac-purple flowers. Spain.

P. villosa bears pale violet flowers with yellowish striped throats, and oval foliage. Greenland; North America.

P. vulgaris (Labrador Violet) is the commonest British species and grows about 6 in. high with pale violet flowers and rosettes of oval leaves. Europe; Lapland; North America.

POLYPOMPHOLYX (Lentibulariaceae) 4 sp. Polypompholyx is a genus of aquatic plants which bear whorls of bladders on top of stiff, bristly stalks. They are somewhat similar to Utricularia, and of no garden value.

P. bicolor comes from Guiana; *P. laciniata* from Brazil.

P. multifida hails from Australia as does *P. tenella*.

RORIDULA (Droseraceae) 3 sp. Name from *ros*, *roris*, dew; meaning the little dewy plant.

R. dentata has woody stems and branches and bears narrow, linear leaves which are concave in the centre. It is thickly covered with tentacles, and according to the specimen in the Kew herbarium appears to grow to a good height. It is not in cultivation. Africa; Australia.

R. gorgonias from Africa and Australia, grows 3 to 4 ft. high and has rose or white flowers.

SARRACENIA (Sarraceniaceae) 9 sp. Named after Dr. D. Sarrasin, a French physician of Quebec. Pitcher Plant; Side Saddle Plant; Boots; Forefather's Cup; Huntsman's Cup; Soldiers' Drinking Cup; Trumpets; Watches.

Sarracenias are perhaps the most decorative of all insectivorous plants, bearing beautifully variegated pitchers, usually provided with a lid or expanding hood covering. The flowers are single, inverted and nodding, with the petals incurved so as to form a smooth dome, and the sepals hanging free. They are quite as decorative as the foliage and last in beauty for several weeks. The pitchers are hollow, and in *S. purpurea* contain a certain amount of water or acid liquids in the hooded forms. Nectar-diffusing glands near the surface attract insects, which, in their eagerness, slip down into the cavity, and are prevented from returning by the presence of downward pointing hairs. Eventually they fall into the liquid collected in the bottom and are drowned; after which the products of decomposition are absorbed by the epidermal cells. It is recorded that in times of drought, birds seek out the plant and regale themselves with water and insects from the pitcher contents. *S. purpurea* and *S. flava* are at times hardy in this country; we have seen plants growing in the gardens of Mr. Arthur Pyke at Windlesham, which have stood the winter very well for the past two years.

S. Drummondii has attractive variegated pitchers from 1 to 2 ft. in height. They are mottled in red, white and green, with white and purple flowers. This species is one of the most striking of the genus. North America.

S. Drummondii var. *alba* has pure white cellular markings at the tops of the pitchers.

S. Drummondii var. *rubra* has reddish-purple pitchers.

S. Drummondii var. *undulata*. The margins of the lids have wavy edges.

S. flava bears erect, narrow pitchers, 2 to 2½ ft. long, of a greenish-yellow shade. The flowers are yellow and very beautiful. North America.

S. flava var. *atrosanguinea* has a dark crimson pitcher and hood.

S. flava var. *limbata*. This variety has a pretty crimson, fringed edging to the hood of the orifice.

S. flava var. *maxima* has very large, yellowish-green trumpets.

S. flava var. *minima* only grows 9 in. or so high, with pale green pitchers heavily reticulated in purple.

S. flava var. *ornata* is lined with purple at the throat.

S. flava var. *Rugelii* has large foliage, with the top of the pitcher and the base of the hood stained dark crimson.

S. laciniata bears green, funnel-shaped pitchers, which become paler and paler until they merge into pure white with conspicuous red veinings. North America.

S. psittacina has small pitchers only 6 in. in length. They are green below, becoming purplish near the hood. North America.

S. purpurea produces green pitchers threaded with red streaks, which are broader and sit flatter than those of most of the species. The flowers are bright purple and green. This is the hardiest *Sarracenia* and quite easy of cultivation. The rhizomes of *S. purpurea* have been used in Canada as a specific against smallpox, but have now been proved worthless. North America.

S. purpurea var. *heterophylla* varies from the type by reason of the pale green pitchers and greenish-yellow flowers.

S. rubra bears pitchers 12 in. long, green, coloured upwards with red, netted veins. The flowers are 3 in. across, reddish-purple in colour and have a pleasant scent of violets. North America.

S. rubra var. *acuminata* only differs from the type in having a more ovate lid.

S. Sledgei has erect, trumpet-shaped pitchers 20 to 30 in. long; they are green with purplish veining. The flowers are yellowish-white and emit a pleasant fragrance. A native of North America, where it occupies vast stretches of swamp land.

S. variolaris (minor) has yellowish-white pitchers streaked with purple. They are about 12 in. in length and hooked over at the lid. The flowers are yellow. North America.

S. undulata bears, as well as pitchers, certain leaves which are not hollowed out, but shaped something like an Iris leaf. Both pitchers and foliage are light green. North America.

Besides the species described, there are many garden hybrids raised by specialists both in this country and America, which are admirably suited for cool greenhouse culture. The following varieties can be recommended.

S. areolata with yellowish-purple pitcher.

S. Atkinsoniana (Atkinsoni) is a beautiful variety with green pitchers covered with a network of red veins.

S. Catesbaei has erect, slender trumpets, 12 to 18 in. long; narrow at the base, but expanding more towards the top. The flowers are green and yellow.

UTRICULARIA (Lentibulariaceae) 210 sp. From *utriculus*, a small skin, in allusion to the presence of bladders on the stems. Bladderwort.

The Utricularias are a race of aquatic or terrestrial plants furnished with entire or rudimentary bladders adapted to the capture of small insect life. They have a wide distribution, although it is only those in the northern hemisphere which bear perfect bladders and make practical use of them. The aquatic forms need no special cultivation and ask only for stagnant, shallow water. One fossil species is known.

U. biflora is a slender, delicate species with a few scattered bladders and two yellow flowers. North America.

U. biloba has blue flowers and grows about 9 in. high. Australia.

U. clandestina (Hidden Fruited Bladderwort) is an interesting species, because it bears flowers of two kinds. Those among the leaves fruit freely: whilst an erect scape, standing out of the water, carries several bright yellow blooms. North America.

U. cleistogama. This North American species rarely produces bladders. It likes to grow in wet soil, and bears numbers of pretty white flowers with purplish lower lips.

U. cornata (Horned Bladderwort) is of delicate constitution with minute leaves and bladders, and racemes of yellow flowers. Newfoundland; North America; Australia.

U. cyanea grows about 6 in. in length and has blue or white flowers. Australia.

U. dichotoma (uniflora) is a slender, unbranched species with no foliage and small purple flowers. Australia.

U. dichotoma var. *alba* resembles the type with white flowers.

U. emarginata forms dense masses of elongated foliage from which arise slender scapes of lavender-blue flowers. Mexico.

U. exoleta is a very slender species with minute yellow flowers. Australia.

U. fibrosa bears quantities of finely-cut foliage and yellow, spurred flowers. North America.

U. flexuosa (Twisted Bladderwort), with much-branched stems, has several yellow flowers in a raceme. Australia.

U. Floridana bears copious bladders and finely-dissected foliage; the flowers are yellow. Florida.

U. gibba has delicate, thread-like stems and foliage, with a few minute bladders. North America.

U. intermedia is an attractive species with dainty fern-like foliage. The flowers are yellow, and the bladders borne on leafless branches. Europe; North America.

U. juncea bears racemes of yellow flowers; the stems, leaves and bladders are minute and delicate. West Indies; North America; Australia.

U. inflata (Swollen Bladderwort) bears quantities of distended bladders and finely-dissected foliage. The flowers are yellow. Florida; Texas.

U. lateriflora has purple flowers. Australia.

U. oligosperma is completely submerged except for the flowers, which are yellow and nearly an inch across. The plant carries plenty of bladders. Brazil.

U. macrorhyncha has several racemes of yellow flowers but very few leaves. Tropical America.

U. monanthos, a small species with minute bladders and a single purple flower. New Zealand; Tasmania.

U. novæ-zelandiæ has white flowers and entire radical leaves. It was found growing upon damp rocks in New Zealand, but is not in cultivation.

U. prehensilis grows in shallow water, producing tangled masses of thread-like stems with minute bladders. We have never flowered the plant and do not know the colour of the blooms. Africa; Australia.

U. protrusa. A slender, floating plant with finely-divided leaves, minute bladders and scapes of yellow flowers. New Zealand.

U. purpurea has dense masses of elongated, much-branched stems. There are no leaves, but bladders are freely produced at the ends of many of the branches. The flowers are violet-purple. Tropical America.

U. radiata has slender, elongated stems with finely-divided foliage and scapes of yellow flowers. North America.

U. resupinata (Reversed Bladderwort) has scattered foliage and solitary violet-purple flowers, which are reversed, so that they are in a cross direction at the back of the flower stalk. North America.

U. reticulata (caerulea) is a native of the inundated rice fields in various parts of the East Indies, where it supports itself on the rice stems, and carpets the ground with a rich blue mantle when in colour. It bears no leaves but the flowers are the same size and colour as a violet.

U. simplex has minute stems, leaves and bladders and spike-like racemes of yellow flowers. Cuba.

U. subulata (Zig Zag Bladderwort) bears zig-zag racemes of yellow flowers: and delicate stems with minute leaves and bladders. North and Tropical America.

U. vulgaris (Common Bladderwort), our native species, produces clusters of bright yellow flowers, six or eight together, raised several inches out of the water. Before flowering the stems and leaves float by help of the minute bladders which are then filled with air: but after the blooms are finished, the bladders fill with water and the whole plant sinks to the bottom. Europe, including Britain.

CHAPTER XIV

Ornamental Grasses and Bamboos for the Waterside

Bamboos are such rustling things;
If close by
You sit listening, you will hear
The swish of a hundred wings
In the sky
Far away, and echo-clear. . . .

For bamboos are never still,
Always they
Are singing some song you know,
Which the sea or the birds fill,
Night and day
To the tiniest winds that blow.

A. R. U.

From *Country Life*. 22. xii. 1928.

IT IS necessary when planting a water garden to create an artistic informality of outline if a natural effect is to be obtained, and perhaps no plants are so suitable for the purpose as the waterside grasses and bamboos. Their slender, graceful habit contrasts with the broader-leaved plants and trees around, whilst the dainty, airy manner of growth causes them to bend and sway with every breath of wind and reflect their willowy beauties in the waters beneath. Grace and elegance are their characteristics, and in no species are the attributes more conspicuous than in the giant grasses known as bamboos. Some care, however, must be exercised in planting, both as to the position and requirements of individual subjects. Background is the great secret of getting the finest effects out of plants grown for their ornamental and decorative features; and at the side of the pool or by the stream bank the bamboo is thoroughly at home. It should, however, be afforded some protection against driving east and north-easterly winds: best effected by the shelter of the windbreaks described in the next chapter.

Bamboos delight in a deep, rich loamy soil; a mulch of manure top-dressed with leaves is beneficial in the autumn, as it not only nourishes the plant and protects it from frost, but does much to preserve the moisture so conducive to success during the growing season. Ordinarily, it takes two or three years for a clump of bamboos to become thoroughly established, and until this is achieved they should receive generous consideration in the matters of feeding, watering and protection.

Propagation is best effected by division of the roots about the latter end of April or May, preferably moving them whilst retaining a ball of soil around the roots. They can also be increased by stem or root cuttings, or by means of seed: the latter an uncertain method and often resulting in failure. Some species flower annually, but others at irregular and very distant intervals: a factor which has contributed largely to the uncertain nomenclature and systematic arrangement, for in some cases it is well-nigh impossible to properly define a plant until its flowers have been examined. A number are monocarpic, dying directly after flowering: a typical example occurring in the period 1933-1936, when all the plants of one form of *Phyllostachys nigra* in the world (young and old alike) suddenly flowered and died, leaving their places to be filled by their seedling offspring.

When planting the coarser reeds and waterside grasses some observations should be taken as to the form of root. If this is of a stoloniferous nature (as so many are), then a watchful eye must be kept on their activities to see that they do not become a nuisance. One way of effecting root control is by planting in cement pockets, using a good turfy loam as compost; or they can be periodically thinned out and divided.

ARUNDINARIA (Gramineae) 80 sp. From *arundo*, a reed. See also Bambusa and Phyllostachys.

A. anceps. A fine ornamental bamboo for a warm, sheltered position. Growing 10 to 12 ft. high, it produces abundant narrow leaves which are distinguished by a circular fringe of short, bristly hairs at the insertion of the leaves. This 'foxtail' characteristic does not become apparent until the plant has been established about three years. Except for this distinguishing feature it somewhat resembles *A. nitida*. China.

A. Fortunei (Bambusa Fortunei). A dwarf Japanese species, growing 3 to 5 ft. high, with long, slender leaves usually striped in

white. It needs plenty of space and sometimes loses its leaves in winter, but produces more in the spring.

A. japonica (Bambusa Metake) has leaves from 8 to 10 in. in length and 1 to 2 in. wide; the upper side smooth and shining, the lower whitened and rough. This, the commonest of the hardy bamboos, is readily distinguished by its broad, glossy leaves and by the presence of brownish sheaths which almost permanently enwrap the stem. It is recommended for town gardens. Japan.

A. Murielae, a charming but recent introduction from China, named in honour of the late Dr. E. H. Wilson's daughter. It closely resembles *A. nitida*, and indeed makes a capital companion shrub for that plant, but the leaves are a lighter green, slightly broader and persist longer in winter. It resembles *A. nitida* too, in that it does not run, so always remains tidy and compact in growth.

A. nitida grows 6 to 10 ft. high, with very slender dark purple stems, festooned with small shiny leaves. This is one of the daintiest of all the Arundinarias, but should be grown in some shade, as the sun sometimes scorches the leaves. China.

A. palmata. A rampant Japanese species, with broad, bright green serrated leaves which show very prominent veining. Height 2 to 5 ft. Japan.

A. pumila (Bambusa pumila). A dwarf species growing only 1 or 2 ft. high, with very slender purplish stems and narrow, bright green leaves (4 to 5 in. long by $\frac{3}{4}$ in. wide). Japan.

A. Simonii. One of the tallest of the genus, attaining a height of 10 to 20 ft. The broad, vivid green foliage is sometimes striped in white and tapers to a fine point. It flowers frequently but does not always die after blooming. An extremely hardy and meritorious species. Himalayas; China; Japan.

A. Veitchii (Bambusa Veitchii) grows 2 to 3 ft. high, with purple, waxy stems and bright green serrated leaves. It is subject to wind damage in the late autumn. Japan.

A. Veitchii var. *variegata* has the foliage lined with white.

ARUNDO (Gramineae) 3 or 4 sp. Derivation from the Latin word *arundo*, a reed. Reed.

Stout reedy grasses with large plume-like terminal panicles; very decorative when planted by the sides of pools or on the banks of streams and lakes. Arundos are partial to rich, well-drained soil and should not be exposed to bitter winds; they

favour plenty of sunlight, but need abundant moisture during the growing season. Propagation by division in early spring.

A. Donax, a magnificent subject, grows from 10 to 14 ft. in Britain, but up to 20 ft. in warmer climes. It produces large glaucous leaves, which are very ornamental, and large panicles of flowers. The stems are used for walking sticks, fishing-rods, fencing, etc. South Europe.

A. Donax var. *macrophylla* has extra wide, dark glossy leaves the undersides of which are glaucous.

A. Donax var. *versicolor* (var. *variegata*; var. *picta*) is a decorative but slightly smaller plant than preceding, with white striped leaves. It is not as hardy as the type and should be protected in winter by a thick covering of leaves.

BAMBUSA (Graminea) 70 sp. Latinised from the Indian name Bamboo.

Economic uses of Bamboos are very great, especially in Asia. The stems are hollow, jointed at the nodes, and the wood hard and elastic owing to secretions of silica in the cell walls; this makes them light yet strong, and as they split easily they are of service in the East for bridge building and making houses. Beehives are fashioned from the stems and they furnish walking sticks, pipes, furniture, household utensils, tools, water-pipes, etc. Split bamboos are made into hats, mats, coarse clothing, ropes and a host of other things, whilst the young shoots are eaten like asparagus and the seeds employed as food. The deposition of silica is used as a medicine for many native complaints, whilst paper and flower pots are other articles made from the plant.

There are no species of Bambusa hardy in the British Isles, but as several genera are now included under the general term of Bamboos, the reader is referred to Arundinaria and Phyllostachys.

CAREX (Cyperaceae) 900 sp. From *keiro*, I cut, in reference to the sharp edges of the leaves. Sedge.

A large genus of grass-like perennials, a few of which are grown in the bog garden. In Kent the leaves of some species were at one time used for hop tying, in Italy they are employed for caulking barrels or for weaving grass covers for Florence flasks. The Laplander combs and dresses some sort of sedge and stuffs his gloves and shoes with it as a protection against the cold in winter. Propagation by division.

C. Buchananii is grown for its handsome reddish foliage which is very narrow and leathery. New Zealand.

C. pendula grows 3 to 4 ft. high with brown, drooping spikelets and coarse, grassy foliage. Europe, incl. Britain; Northern Asia.

C. Pseudo-cyperus is one of the best for waterside planting, producing bright green, grassy leaves and drooping, many-flowered spikelets of dark green. Height 2 to 3 ft. Europe, incl. Britain; North America; Asia; Australia.

C. riparia, a coarse grass with broad leaves and brown spikelets. North temperate regions, incl. Britain; Australia.

C. stricta var. *Bowles' Golden* is a most decorative sedge for shallow water, with rich golden-yellow foliage. Height 15 in.

CLADIUM (Cyperaceae) 30 sp. From *klados*, a branch or twig, referring to the appearance of the plant. Twig Rush.

C. Mariscus (*C. germanicum*), a tall, rush-like plant with leafy stems, 3 to 6 ft. tall, and grassy leaves with a prickly, saw-like edge. Propagated by division. Europe, incl. Britain.

COIX (Gramineae) 6 sp. The old Greek name.

C. Lachryma-Jobi (Job's Tears). A quaint annual grass sometimes planted in the shallow water of the indoor pool. It grows 2 to 3 ft. high, producing insignificant flowers, and large pearly-white to lead-coloured seeds, which are very hard and hang down like tear drops. Having a starchy endosperm, they yield a flour when ground, and are cultivated for food in the Khasia Hills and in Burma. They are also used for medicine in China, and to this end are fashioned into necklaces which are reputed to have marvellous properties. East Indies and all tropical countries.

C. Lachryma-Jobi var. *aurea zebrina* has the foliage striped with yellow.

CORTADERIA (Gramineae) 10 sp. The native name in Argentina. Pampas Grass.

The introduction of the large-foliaged Pampas grasses to the waterside lend an air of exotic grandeur and enables one to obtain faint glimpses of the splendour of tropical vegetation. The plants should be stationed singly, that the full beauty of development may be appreciated, and in an open, sheltered position, preferably close to water so that the reflections may be mirrored. Propagation by division.

C. Selloana (*C. argentea*; *Gynerium argenteum*) grows to a

height of 3 to 6 ft. and bears long, silver-white plumes. South America.

C. Quila (*Gynerium roseum* Rendlateri) has lavender-coloured plumes which are more feathery in appearance. South America.

CYPERUS (Cyperaceae) 418 sp. Ancient Greek name.

A large genus of the sedge family inhabiting both temperate and tropical countries; several cultivated for their decorative effects in the bog garden. Increase by seed or division, or from the young plants that grow on top of the leaves. *C. esculentus* is cultivated in southern Europe for its fleshy tubers which are reputed to be excellent eating with a flavour similar to potatoes. They are also said to form a passable substitute for coffee and to be used in Spain for flavouring ices and making a popular beverage known as Chufa. In other countries cakes are made from them, and, according to Pailleux and Bois in *Le Potager d'un Curieux*, they also furnish an excellent oil and make a good spirit of the nature of brandy. Certain species of *Cyperus* are cultivated for the flower stalks, of which matting and ropes are made: *C. corymbosus* var. *scariosus* and *C. partenuis* of India are fragrant and used in perfumery. Perhaps the most striking member of the genus is *C. Papyrus*, the plant which furnished the first writing paper of the ancient Egyptians. The method of procedure is described in Chapter I. The Ancients also made use of the *Papyrus* in other ways, plaiting it into mats and sails and making sandals and little boats. It was long thought to be abhorred by the crocodile, which leads us to suppose—together with the abundance of plants present in these parts—that the cradle which sheltered the infant Moses was constructed from *C. Papyrus*.

C. alternifolius (Umbrella Palm; Umbrella Grass) is a most useful plant for it is equally happy in or out of the water. Being tender it must be wintered indoors and can be grown in a pot plunged in the pool for the summer, and taken as a room plant in the winter. It grows 1 to 3 ft. high with flat, grassy, umbrella-like heads of leaves. Madagascar.

C. alternifolius var. *flabelliformis* has a horizontal stoloniferous rhizome and stout, spongy leaves 2 to 4 ft. high. The umbel contains about twenty spreading or drooping leaves, each 4 to 8 in. long, with numerous flat, pale brown spikelets. It is a pretty plant of a tall and palm-like nature, and used by the African native for wicker work. Not hardy. Abyssinia; Arabia.

C. alternifolius var. *gracilis*. A smaller and slenderer species, forming tight, compact clumps of wiry stems and less-spreading involucre of leaves. Height 18 in. Not hardy. Madagascar.

C. alternifolius var. *variegatus* has the stems and leaves handsomely striated in white. Any pure green foliage that appears should be removed to encourage this variegated feature. Not hardy.

C. congestus (*C. paramattensis*). A very fine species that has proved hardy in sheltered positions, needing deep, rich soil and very shallow water. It grows about 2 ft. high with attractive heads of reddish-brown glumes. Old World Tropics.

C. diffusus (*C. elegans*; *C. laxis*) has fibrous roots with a solitary stem, 1 to 3 ft. high, and many glossy marginal leaves. The spikelets are greenish-yellow and surmounted by long involucre leaves (4 to 15 in.). It is much used for edging the indoor pool or for table decoration. Not hardy. Tropics.

C. Eragrostis (*C. vegetus*). An attractive hardy grass for a few inches of water, with bold, grassy, radical leaves and crowded umbels of mahogany spikelets. Height 2 ft. Chile.

C. erythrorrhizos (Red-rooted Cyperus). A pretty annual species, growing from 6 to 24 in. high, with compound spikes of bright chestnut-brown scales. Reproduced by seed. Ontario to Texas.

C. filicinus (*C. Nuttallii*). A slender annual species, growing 4 to 18 in. high, with loosely-clustered yellowish-brown spikelets. It is hardy and sometimes grown for pondside decoration. North America.

C. flavescens (Yellow Cyperus). A pretty little annual, growing only 3 to 12 in. high, with crowded umbels of bright yellow spikelets. North America.

C. Haspan grows 1 to 3 ft. high bearing a few spikelets of reddish-brown flowers. Tropical America, also warmer parts of Europe, Asia and Australia.

C. Haspan var. *adenophorus*. An attractive greenhouse variety, producing rigid stems, 18 in. high, surmounted with graceful 'mop' heads of spikelets. Madagascar.

C. Haspan var. *viviparus* resembles a miniature Papyrus with round 'mop' heads on which the young plantlets frequently grow whilst still attached to the parent. Not hardy. Height 2 ft.

C. longus (Sweet or English Galingale). A beautiful native

species, highly decorative at the pond margin. Growing 2 to 4 ft. tall, it produces tufts of grassy foliage, terminating in lax umbels of dark chestnut-brown. Europe, incl. Britain; Orient.

C. natalensis from a hard, long rhizome produces triangular stems, 2 to 3 ft. high, bearing rather dense umbels of brownish spikelets and about three small leaves. Not hardy. Natal; Australia.

C. Papyrus (*Papyrus antiquorum*) (Egyptian Paper Plant; Papyrus). A beautiful and graceful species, growing 12 to 16 ft. high, with heavy 'mop' heads of greenish-brown inflorescence. It is tender and should be wintered in a frost-proof house. In Mr. Syngé's book, *Mountains of the Moon*, he states that in its native habitat one year's growth of Papyrus will reach 8 to 10 ft.: and mentions that paper pulp and power alcohol can be made from the plant. The Uganda peoples use it for rafts, binding the stems tightly together in bundles. It is also used for thatching. Syria; Tropical Africa.

C. rotundus (Nut-grass). A perennial bearing round, nut-like tubers and half to three-inch wide grassy leaves. The spikelets are borne in clusters and are dark purplish-brown with green margins. Hardy. Almost world-wide distribution.

C. strigosus grows 1 to 3 ft. tall, with exceptionally dense and heavy heads of straw-coloured spikelets. It is a stout plant, perennial by means of tuber-like corms. North America.

ELYMUS (Gramineae) 50 sp. Greek name for a kind of Millet. Lyme Grass; Wild Rye.

E. glaucus is a strong perennial grass growing from 3 to 4 ft. high; it has narrow, silvery foliage and erect, elongated rye-like spikes. North America.

ERIOPHORUM (Cyperaceae) 15 sp. Name from the Greek *erion*, wool, and *phero*, I bear. Cotton Grass.

Pretty bog plants, easily cultivated, and reproduced by seeds or division. In former times the leaves, root and pith of the stem were considered of medicinal value because of their astringent properties, and the silky down was gathered for stuffing pillows. Owing to its aptness to absorb moisture and cake together it had, however, little practical value. Some attempts have been made to use it as a substitute for cotton, and quite passable cloth and thread were made; but the fibres are shorter and consequently do not bear twisting as well.

E. alpinum (Alpine Cotton Grass). Usually found at high

altitudes, this slender species grows 6 to 10 in. high, with small, solitary, oval heads of cottony inflorescence. Scotland; North America; Northern Asia.

E. angustifolium. A common British species, forming neat clumps of rush-like foliage and numerous erect, white-tufted heads. The 'wool' is sometimes used in country districts for making candle wicks. North temperate and frigid regions.

E. Chamissonis grows about 15 in. high, bearing tufts of broad, grassy foliage, and attractive light chestnut-brown heads of inflorescence. Siberia; North America.

E. gracile grows 1 to 2 ft. tall, with very narrow foliage and three to eight bright white, drooping spikelets clustered in a head. Europe, incl. Britain. North temperate regions.

E. latifolium is a slender species, 12 to 18 in. high, with rough, flattened leaves and several white, drooping spikelets with dark purplish-green scales. One of the prettiest of the genus. North temperate and frigid regions.

E. russeolum grows about 18 in. tall, carrying solitary purplish-brown spikelets, with bright reddish-brown bristles. It is one of the most distinct and hails from North America.

E. Scheuchzeri (*E. capitatum*) is not as pretty as some, and grows 12 to 18 in. high, with solitary, yellowish-white spikelets. Europe; North America.

E. vaginatum, of tufted habit, grows 10 to 12 in. high, bearing stiff, triangular, rough leaves and a single erect, white, glossy spike about 1 in. across. Europe, incl. Britain; Asia; North America.

E. virginicum has dingy brown spikelets. North America.

EULALIA. See MISCANTHUS.

GLYCERIA (Gramineae) 40 sp. From the Greek *glukeros*, or *glukos*, sweet, alluding to the foliage. Manna-grass.

Pretty perennial grasses for the waterside, and of some importance in providing grain food for wild fowl. *Glyceria fluitans* produces abundance of seeds, which are eaten by geese, ducks and some fish—especially trout; and the grass is greatly relished by horses, cattle and pigs. In parts of Germany and Poland the seeds are gathered—under the name of manna seeds—and because of their nutritive properties used in soups and gruel. Propagation by seeds and division. They need to be kept under control.

G. aquatica (Reed Manna-grass). A stout, reed-like grass, 4 to

6 ft. high, with a branched panicle of greenish spikelets. It is only adapted for wild gardens or large lakes, in which situations it affords fine shelter for wild fowl. Europe, inc. Britain; North temperate regions.

G. aquatica var. *variegata* (*G. spectabilis*). One of the prettiest waterside grasses, growing 18 in. to 2 ft. high, the foliage regularly striped with green, yellow and white. During the spring and late autumn they are also suffused with a rosy tinting, which adds to the attractiveness. The roots should be kept in a confined area in a small pool or else thinned out occasionally.

G. canadensis (Rattlesnake Grass). The most handsome individual in the genus, this showy plant grows 2 to 3 ft. tall with a drooping panicle, somewhat resembling on a larger scale the pretty Quaker Grass of our meadows. Swamps and marshes of North America.

GYNERIUM. See CORTADERIA.

MISCANTHUS (Gramineae) 10 sp. From the Greek *miskos*, a stem, and *anthos*, a flower; the flower spikelets are stalked. Eulalia.

Tall perennial grasses with feathery, fan-shaped panicles, allied to Saccharum—the Sugar Cane. They are often listed as Eulalias. All the Miscanthus are shown to best advantage when planted singly, so that the full beauty of their development may be appreciated. They prefer a moist, sunny position and a deep, rich compost: the crowns of the variegated-leaved sorts should be protected with leaves in the winter. Propagation by seeds or division.

M. saccharifer (*Imperata sacchariflora*) (Hardy Sugar Cane). A vigorous Japanese species growing 6 to 10 ft. high, with reedy stems and terminal panicles of silky spikelets.

M. saccharifer var. *variegata*. Similar to the type, but with variegated foliage.

M. sinensis (*Eulalia japonica*) is a fine hardy perennial grass of robust growth, reaching from 5 to 8 ft. in height. The leaves are deep green, about $1\frac{1}{4}$ in. wide, with a prominent white stripe down the centre. Each is from 2 to 3 ft. long and the flower panicles are purplish. Japan.

M. sinensis var. *gracillimus* (*Eulalia gracillima univittata*) grows from 5 to 7 ft. in height with large, showy, brown panicles. The leaves are very narrow and have a thin white stripe running down the centre of each.

M. sinensis var. *variegatus* does not grow quite as tall as the

type; the leaves are striped longitudinally with white, the stems being green and white suffused with pink.

M. sinensis var. *zebrinus* is a variegated form with the leaves barred in alternate stripes of white and green.

ORYZA (Gramineae) 12 sp. From the Arabic *ar-roz* and the Greek *oruza*. Rice.

O. sativa. The common rice of commerce can easily be grown in the indoor pool, and will reach about 12 ft. in height with grassy leaves and flowers. It is more interesting than beautiful. Old World Tropics.

PANICUM (Gramineae) 500 sp. Old Latin name of Italian Millet. A genus of grasses, many of them being important cereals.

P. virginatum is a very ornamental plant of erect and robust habit, producing large branching panicles of purplish flowers. Propagated by division in spring or autumn. N. America.

PAPYRUS. See CYPERUS.

PHALARIS (Gramineae) 20 sp. The old Greek name used by Dioscorides.

P. arundinacea (Reed Canary-grass) is sometimes recommended for planting in parks alongside streams and lakes. A tall perennial, it grows 2 to 6 ft., with flat, wide leaves and showy purple-tinged panicles of flowers. Propagated by seeds or divisions. A native of the north temperate and Arctic regions; in North America it has valuable forage properties.

P. arundinacea var. *picta* (Ribbon Grass; Gardener's Garters) has the foliage longitudinally striped with white. The plant is similar but inferior to *Glyceria aquatica* var. *variegata*.

PHRAGMITES (Gramineae) 3 sp. From the Greek *phragmos*, a fence, apparently from its compact hedge-like growth along ditches. Reed.

P. communis (*Arundo Phragmites*) (Common Reed). A strong, growing grass with the aspect of *Arundo*: often used for wild-fowl cover in intensive lakeside plantings. Growing 6 to 10 ft. high, it produces broad, glossy leaves and heavy purple or violet plumes of flowers. In Cornwall the plant is locally known as Goss, and the stiff stems are used for thatching. As a growing plant the reed is valuable for its quality of binding the sands on the shore, and is much used for the purpose in France, being planted on the sea coast along with *Pinus maritima*. Propagated by division or seeds. Temperate regions, including Britain.

P. communis var. *variegata* (Spire Reed) has variegated leaves.

PHYLLOSTACHYS (Gramineae) 25 sp. From *phullon*, a leaf, and *stachys*, a spike; the inflorescence is in leafy spikes. See also *Bambusa* and *Arundinaria*.

P. aurea (*Bambusa aurea*). A graceful plant, growing 10 to 15 ft. high, carrying brilliant yellow stems festooned with pale green leaves having a glaucous reverse. Being extremely narrow, these stir and rustle in the slightest breeze, giving the plant an airy, delicate effect. China and Japan.

P. Henonis (*Bambusa Henonis*) is a very graceful form with glossy green leaves. The young stems are arched and bright green, becoming yellowish with age. The plant grows from 6 to 15 ft. according to soil and position: it is quite hardy. Japan.

P. nigra (Black Bamboo) grows from 8 to 15 ft. high, the stems being green at first, quickly turning to black as they get older. The leaves are from 2 to 6 in. in length, very thin, with a glaucous reverse. China and Japan.

SACCHARUM (Gramineae) 12 sp.

S. officinarum (Sugar Cane) is sometimes used as a decorative greenhouse subject. From the rhizome there spring each year stout stems, 12 to 15 ft. high, with grassy leaves and a dense woolly spike of inflorescence. It is the East Indian Sugar Cane of commerce. Eastern Asia.

SCIRPUS (Cyperaceae) 200 sp. The old Latin name used by Pliny for a rush. Bulrush.

A large and widely distributed genus of plants found in wet moors, bogs and marshes. Noble aquatics when grown in colonies; the roots, being of a stoloniferous nature, need some restriction in the small pool. Propagation by suckers, division or seed.

S. cernuus (*Isolepis gracilis*). A favourite plant for conservatory decoration, with very slender, hair-grass stems, which are erect or more often drooping. Small whitish or pale brown spikelets appear at the summit of the stems. Cosmopolitan.

S. Holoschoenus. A stiff rush-like plant with cylindrical stems, 1 to 3 ft. high, and one or two rigid leaves sheathing the base. The spikelets are very numerous, being clustered together in round heads. Europe, incl. Britain; Asia.

S. Holoschoenus var. *variegatus* is of more decorative value, with the stems alternately banded in green and yellowish-white.

S. lacustris bears fat, dark green rushes and attains a height

from 3 to 8 ft. Umbels of chocolate-brown flowers are borne near the tops of the stems. In early times this plant was known as the Pool Rush, now corrupted to Bulrush: it is still used in country districts for making mats, ropes, chair bottoms and hassocks, and in California, under the name of 'Teele', is employed in paper making. Europe, incl. Britain; North America; Asia.

S. maritimus (Sea Club-Rush). A common rush, growing 3 to 5 ft. high, with sharply triangular stems and long spikelets of chocolate-brown flowers. Universal distribution.

S. setaceus (*Isolepis setacea*) is very similar to *S. cernuus*, but only grows 3 or 4 in. high. It makes a pretty marginal plant for the pond and does not become too rampant. Europe; Australia; Asia.

S. sylvaticus (*S. atrovirens*) is of compact habit, producing triangular leafy stems 2 to 4 ft. high. The leaves are coarse and grassy, very dark green, and the spikelets composed of dense, greenish-brown heads of flowers. North America.

S. Tabernaemontani differs from *S. lacustris* in having glaucous stems and other small botanical distinctions.

S. Tabernaemontani var. *zebrinus* (*Juncus zebrinus*; Porcupine Quill Rush; Zebra Rush). A handsome plant of Japanese origin with the stems alternately banded in green and white. It grows 4 to 5 ft. in height and is most effective when planted in masses in shallow water.

S. triqueter is a quaint plant with leafless, sharply triangular stems, 2 to 2 ft. high, and lateral clusters of spikelets. A rare native, it is also found in Europe and Australia.

SPARTINA (Gramineae) 7 sp. From *spartine*, a cord, alluding to the use of the foliage. Cord-grass; Mat Weed.

Strong, tough-leaved grasses of little horticultural value but serviceable as mud-binders and important factors in the reclamation of salt marshes. The following kinds are occasionally grown for their services in this respect on loose banks of pools and streams. They should not be introduced to the water garden unless necessary for such a purpose. Propagation from seeds or by division.

S. cynosuroides var. *aureo marginata* grows 5 to 6 ft. high and has golden margins to the leaves.

S. Townsendii grows 2 to 4 ft. high with dark green foliage and 3 to 5 spikes. It is a natural hybrid of *S. stricta* and *S. alterniflora*, both of which occur in Britain.

STENOTAPHRUM (Gramineae) 7 sp. From the Greek *stenos*, narrow, and *taphros*, a trench, the spikelets being situated in cavities in the rachis.

A small genus of creeping grasses found chiefly by the sea, where they perform some service in binding the sands. The variety described below is sometimes grown amongst taller aquatics or it makes an excellent basket plant. Propagation mostly by cuttings.

S. secundatum var. *variegatum* (*S. americanum* var. *variegatum*; *glabrum variegatum*) (St. Augustine Grass) has blunt leaves, 2 to 4 in. long, prettily variegated in green and gold. It is of prostrate habit and somewhat resembles a miniature bamboo. Not hardy.

UNIOLA (Gramineae) 8 sp. The Latin name of some unknown plant, perhaps derived from *unio*, unity. Spike Grass.

U. latifolia grows 2 to 4 ft. high, with broad, flat leaves and graceful panicles of large, thin flowers. The plant is sometimes cultivated for the inflorescence, which is suitable for dried bouquets. Propagation by division. North America.

ZIZANIA (Gramineae) 3 sp. Adapted from *Zizanon*, the old Greek name of some grain. Water or Indian Rice; Canadian Wild Rice; Water Oats.

Z. aquatica (*Z. palustris*; *Hydropyrum esculentum*). A very desirable aquatic grass, being one of the handsomest for pond-side decoration. It is an annual, growing 8 to 9 ft. high, with broad, flat leaves, reedy stems and large terminal panicles. The grain is excellent for fish and water-fowl, especially teal, duck and widgeon, and is also used as a cereal by the North American Indians. Having had seed sent over from Canada this year, we sampled the 'rice' ourselves and found it excellent eating with a more delicate flavour than ordinary rice. Some years ago an attempt was made to popularise it in this country, and large quantities were grown in the Fen district, but, like many other laudable efforts, the attempt failed and now *Z. aquatica* is only grown to grace our water gardens. When sowing seed, place it in deep water (up to 5 or 6 ft.) or on low, marshy ground which is always under water. In running-water it should be sown as far away from the current as possible. Canada; North America.

Z. latifolia is smaller than the preceding, growing only 3 to 5 ft. high. Siberia.

CHAPTER XV

Backgrounds and Windbreaks

'And pendant branches trail their foliage fine
Upon his watery face.'

ROBERT BRIDGES

THE WATER-LILY pool in an exposed position needs some protection from inclement weather if the best results are to be obtained, and also a certain amount of background to give it the natural setting which adds so much to the charm. If room is available, nothing is more suitable for the purpose than trees.

Where space is limited, nothing makes a finer hedge or belt than the evergreen Norway Spruce (*Picea excelsa*) or closely planted specimens of *Cupressus macrocarpa*. The former can be pruned back each season, and will make a thick hedge, affording adequate shelter to the pool. Other trees and shrubs can be introduced for their beauty of form, foliage or flower. The Weeping Willow should be planted singly, in a position overhanging the water, so that the full grandeur of its development can be appreciated. The long, narrow foliage is generally white on the under-surface, and as the breeze blows each pliant osier rod turns to show the undersides of its leaves, and the tree suddenly changes from bright olive-green to white.

Given a fairly rich soil and a sunny (not wet) situation, Wistarias will flower freely, and, when used in such a position as close to a bridge spanning a stream, soon transform it into a charming picture. The Dogwoods, with brightly coloured stems in winter; or Alders, flaunting long-tailed catkins in the bleak cold days before anything else is stirring; the Bog Cypress, whose feathery fernlike foliage changes in autumn from pale green to a crimson fiery raiment, are other trees to introduce for charm and effect.

When planting trees or shrubs, see that the ground is in a moist condition (not wet and sticky), and, if the ball around the roots is at all dry, give it a good soaking before planting. This is particularly important with conifers, which die more from dryness

when first planted than from any other cause. The tree should not be set in the ground any deeper than it was prior to lifting, and if received in frosty weather should be placed in a frost-proof cellar until a thaw sets in. Grass and weeds should not be allowed their freedom for at least five or six years after planting; they starve the roots of adequate moisture during the spring and summer rains. On light grounds, mulchings of manure or garden refuse may advantageously be applied, but not too near the trunk of the tree. To compensate for unavoidable loss of root, newly-planted specimens can have all surplus branches removed; and quickly growing trees—such as willows and poplars—should have their branches shortened the following March after planting.

The whole of the following are worthy of cultivation, and will succeed in moist or wet positions in the water garden or on the drier slopes around.

ACER (Aceraceae) 150 sp. Classical Latin name. Maple.

Handsome trees, with large foliage which shows remarkable variation in shape and colour; many are valuable timber trees and some produce sugar. A few favour wet, swampy soil and may advantageously be introduced for effect into the bog garden.

A. rubrum (Swamp or Red Maple). A fine tree of upright habit, but slow-growing and averse to lime in the soil. The flowers are bright red in spring, but in autumn, when the leaves become bright scarlet and orange, they light the garden like a torch of fire. Height 80 to 100 ft. North America.

A. saccharinum (White or Silver Maple). So called by Linnaeus, who mistook it for the Sugar Maple (*A. saccharum*). It grows well in moist situations, producing spreading, slender branches and handsome leaves which turn yellow in autumn. Eastern North America.

ALNUS (Betulaceae) 25 sp. The ancient Latin name, compounded from *al*, near, and *lan*, the edge of a river, in allusion to the habitat. Alder.

The genus, with a few exceptions, grow in wet, swampy positions, too moist even for the willow; and are planted for the beauty of the male catkins in spring and for the wood which is extremely durable in water. According to old historians, the first boats were made from alder and it was also used for bridge piles, the famous Rialto in Venice being a case in point. The bark of the young tree is a powerful astringent and both it and the catkins

produce a dye, whilst the split roots can be fashioned into baskets. The growing tree is also much valued to keep up the banks of rivers.

A. glutinosa (*A. vulgaris*; *A. rotundifolia*) (Black Alder) is our British species, a vigorous-growing tree with a loose, negligent habit and dull green, orbicular foliage. In favoured localities the tree will grow up to 50 ft. high and is only suitable for naturalising in extensive plantings. Europe; North Africa; Asia.

There are many varieties of the type, including one with yellow leaves (var. *aurea*) and another with red veining and petioles (var. *rubrinerva*).

A. japonica is perhaps the handsomest of the genus, but prefers a drier position. It forms a tall, pyramidal tree, 50 to 80 ft. in height, and has dark green, lanceolate leaves, small black cones and hanging male catkins. Japan.

A. Mitchelliana (American Green Alder). An attractive hardy shrub with handsome, bright green foliage (which is aromatic when unfolding) and long male catkins. It grows 2 to 10 ft. high, is of compact bush habit, and will grow in very wet situations. Mountains of North-East America.

ANDROMEDA (Ericaceae) 6 sp. Greek mythological name. Evergreen shrubs of low stature, adapted for planting in front of shrubberies or rockeries. They carry narrow, rich green leaves, and pinkish-white flowers tipped with red, borne freely in drooping racemes from May until the end of September. The genus is perfectly hardy and delights in a moist, peaty compost and a semi-shady position. Propagation by seed, divisions and cuttings.

A. glaucophylla is of branching habit, the young stems often glaucous, with racemes of pinkish flowers. North-East America.

A. polifolia (Marsh Rosemary) is more graceful than the preceding species and grows 6 to 24 in. high, with narrow, whitish-green foliage and clusters of bell-shaped, slender-stalked flowers. N. Europe; N. Asia.

ARCTOSTAPHYLOS (Ericaceae) 30 sp. From Greek words meaning bear and grape. Bearberry.

Handsome shrubs, grown for their ornamental flowers and fruits, and also for the evergreen foliage which has some medicinal value. The flowers of the Arctic species, which are bell-shaped and borne in terminal racemes, appear directly the snow melts in their native habitats.

A. Uva-ursi (*Arbutus Uva-ursi*) has small, tapering, oval leaves

and tiny white flowers tinged with pink. A hardy evergreen of trailing habit; it is useful for carpeting sandy banks or rocky stones near the water's edge. Hardwood cuttings, taken about September, root readily under glass. Northern Hemisphere.

AZALEA. See RHODODENDRON.

BETULA (Betulaceae) 38 sp. Ancient Latin name. Birch.

Birches have a wide distribution, and few trees have more grace or are so decorative. The elegant, pendulous branches, at times hung with delicate catkins, carry bright, dainty leaves which have the advantage of being but rarely attacked by insects. Even in winter, the erect, silver trunks add a touch of colour to the landscape. The majority prefer moist, sandy soil, although a few such as *B. pendula* and *B. nana* are adaptable, making excellent water-side trees but growing equally happily in dry situations. Propagation is effected by means of seeds sown in sandy soil and transplanted when about one year old. Sometimes the rarer sorts are grafted, usually on to *B. pendula*, *B. nigra* or *B. lenta*; whilst budding is also practised. The shrubby forms can be layered and *B. nana* reproduced by softwood cuttings under glass.

The genus has some economical properties. Oil from the bark is used in tanning Russian leather—to which it conveys its own fragrance—and the hard, tough wood is used for making charcoal, shoes, boxes and baskets. Also, in North America, canoes are fashioned from *B. papyraceae*.

B. Maximowiczii is a Japanese species, with large leaves—much larger than those of any other birch—and under favourable conditions will grow 80 to 90 ft. high. It is one of the most ornamental of the genus, with dull orange branches and bark, and has attractive hanging catkins. Japan.

B. nana (Dwarf Birch) is very distinct, being of low, spreading habit, rarely exceeding 4 ft. in height, and succeeds admirably in boggy situations. Arctic North America; N. Europe; Siberia.

B. nigra (River or Red Birch) loves a moist position, as on the margins of pools and streams where the roots may run down to the water. It has a reddish-brown bark (or silvery on the younger branches) which becomes slit and ragged, giving the trunk an attractive ribboned appearance. North America.

B. occidentalis (Black Birch) may grow as much as 100 ft. high, and delights in a wet situation. It is of pendulous habit with a dark green bark. North America.

B. pubescens (White Birch) grows into an upright, spreading tree some 60 ft. in height, with oval leaves which are downy beneath when young. The type is found in swamps in North and Central Europe, also Siberia. Varieties include var. *variegata*, an inconstant form with variegated leaves.

B. verrucosa (*B. pendula*; *B. alba*) (Silver Birch) is our own elegant native tree, and grows about 60 ft. in height, with slender, usually pendulous branches and beautiful silver trunks.

There are many forms of the common Birch, including var. *purpurea* which is very distinct, with a drooping habit and dark purple leaves; var. *Youngii* (*pendula elegans*), a graceful birch of free growth which forms an irregular head and droops all round; and var. *dalecarlica*, with the leaves all more or less deeply lobed.

CLETHRA (Clethraceae) 30 sp. Ancient Greek name of the Alder; transferred to this genus on account of the similarity of the leaves.

A genus of neat bushes or small trees, which grow well in peaty soil in a sheltered position. All bear handsome spikes of white, fragrant flowers during the late summer, which renders them attractive subjects for lake or streamside planting. Propagation by seeds, layers or cuttings.

C. alnifolia (Sweet Pepper-bush), from North America, forms a loose bush, 4 to 6 ft. high, with erect, fragrant panicles of flowers at the summits of the branches.

C. alnifolia var. *rosea* is distinguished by the flowers being pinkish.

C. alnifolia var. *paniculata* is one of the most ornamental on account of the very long terminal panicles of flowers. It is superior to the type, quite hardy and a vigorous grower.

There are also several evergreen species, but they are not really hardy in this country and will only stand a few degrees of frost.

CORNUS (Cornaceae) 60 sp. Ancient Latin name. Dogwood; Hound Tree.

The Dogwoods are useful trees and shrubs which are decorative at all seasons of the year. A few are conspicuous on account of their variegated foliage, or the gaily-coloured flowers produced in profusion in early spring. Others are noted for the richly-hued fruits; but the chief commendation would appear to be the bright red-barked stems, which in winter give such a welcome colour to

the landscape. As they grow equally well in shady positions as they will in sun, and flourish in almost any soil, their value is enhanced. All the Dogwoods with coloured stems should be cut hard back after flowering (in April) to encourage this feature, for it is the new wood that shows the most vivid coloration. Propagation by seeds, cuttings, layers, budding or grafting.

Economic properties are varied. *C. florida* furnishes a useful substitute for quinine, whilst the powdered bark of some is supposed to make good tooth-powder and, when mixed together with sulphur of iron, provides an excellent black ink. Skewers and tool-handles are fashioned from the wood which is tough and close-grained, and the small red berries of *C. suecica* are eaten by the Esquimaux. *C. sanguinea*, the common Dogwood, is so called because a decoction of the bark was at one time employed for washing mangy dogs; whilst the fruits of the Cornelian Cherry (*C. mas*) are reputed to be antiseptic, and during the cholera plague in Constantinople were the only fruits allowed for sale in the streets. They are about the size and shape of an olive and occasionally used as substitutes.

C. alba is a fine, erect shrub, with bright blood-red branches and white to bluish-white, oval fruits. Siberia; North China.

C. alba var. *elegantissima*, a rich silver variegated form with red stems, invaluable for brightening the dark spots of the bog garden.

C. alba var. *Gouchaultii* has the foliage variegated in yellow and pink.

C. alba var. *Kesselringii* has very dark purple stems.

C. alba var. *Spaethii*. The leaves of this variety are broadly edged with yellow.

C. florida (Flowering Dogwood). So called because of the exceptionally large white or pinkish flowers, which are 3 to 6 in. across. The leaves assume autumn colouring and the shrub is of spreading habit, growing 10 to 15 ft. high. Fruits scarlet. Being native to north and central America, the plant should be afforded a sheltered position, but when once established flowers freely. Var. *pendula* has pendulous branches, and var. *rubra*, rosy-pink flowers.

C. macriphylla (*C. brachypoda*) is a strikingly handsome species, with dark green leaves which become heavily tinted with orange in the autumn. The large panicles of white flowers are succeeded by bluish-black fruits. Japan; China.

C. mas (Cornelian Cherry) is a small tree of spreading habit,

10 to 20 ft. high; most attractive in February and March with a profusion of yellow flowers on the naked wood. These in turn give place to bright red fruits, and the foliage assumes bronzy-red tints in autumn. Europe; Orient.

C. sanguinea (Common Dogwood) grows 6 to 10 ft. high, with brilliant scarlet branches, greenish-white flowers and black berries. Europe; Orient.

C. sanguinea var. *variegata*. A poor form, similar to the type, but with variegated foliage.

C. stolonifera (Red-Osier Dogwood). Of shrubby habit, growing 6 to 8 ft. high, with purplish-red branches, white flowers and white fruits. The leaves are oblong to egg-shaped. Canada.

C. stolonifera var. *flaviramea* is a very fine variety with yellow branches.

GAULTHERIA (Ericaceae) 120 sp. Named by Kalm after Dr. Gaulthier, a physician in Quebec, whose real name was Gaultier.

G. procumbens (Wintergreen; Checkerberry; Boxberry; Partridge Berry). A dwarf evergreen shrub, with aromatic foliage, and solitary white flowers succeeded by scarlet berries. This fruit is edible and an aromatic oil, used for perfumery and in medicine, is distilled from it. The plant likes to grow in shady, somewhat moist soil, in a partially shaded position. Propagated by layers, suckers or divisions of older plants, also occasionally by seed or half-ripe cuttings. Canada.

G. Veitchiana forms a compact shrub some 3 ft. high, with oblong leaves and racemes of white flowers. These are followed by indigo-blue fruits in late summer. China.

HIPPOPHAE (Elaeagnaceae) 2 sp. From *Hippophaes*, the ancient Greek name of a spiny plant. Sea Buckthorn.

Ornamental, woody plants grown for their silvery foliage and shiny, golden fruit. As staminate and pistillate flowers are found on different plants, it is advisable to plant specimens of each to ensure plenty of berries. They grow well in almost any kind of soil and owing to the spreading manner of growth have been used for the fixation of shifting sand dunes. Propagation by hardwood and root cuttings, suckers and layers.

H. rhamnoides grows 10 to 20 ft. high, with grey, often spiny branches and linear-lanceolate leaves. During the late summer it is nearly weighted down with small orange berries. Europe, incl. Britain; West and Central Asia; West China; N.W. Himalayas.

H. rhamnoides var. *angustifolia* is a variety with pendulous branches.

HYDRANGEA (Saxifragaceae) 80 sp. Name from Greek *hudor*, water, and *aggeion*, vessel, alluding to the cup-shaped fruit.

To the late Dr. E. H. Wilson we owe the introduction from China of the best of these well-known showy shrubs. Carrying large panicles of white, pink or blue flowers, a few specimens can advantageously be situated at the waterside; but the planting must not be overdone, their over-use creates monotonous and inartistic effects. They are only hardy in the south and south-west of England, and even there should be placed in a sheltered spot; the soil should be rich, porous and somewhat moist. Propagation is effected by hardwood cuttings, layers or suckers.

H. Hortensis. The common hydrangea from China may be grown out of doors in favoured localities. There are many forms and varieties.

H. paniculata (Plumed Hydrangea). A small tree, reputed to grow 15 to 20 ft. tall, but which more usually (in this country) forms a compact shrub several feet high. Flowers are freely produced in massive heads which terminate every branch in autumn. China; Japan.

H. paniculata var. *grandiflora* has very large and showy panicles, in which almost all the flowers are sterile and enlarged.

H. strigosa var. *macrophylla* (*aspera* var. *macrophylla*). A magnificent, hardy Chinese variety, annually laden with large heads of pale porcelain-blue cymes, surrounded by lilac-pink sterile florets.

KALMIA (Ericaceae) 6 sp. Named after Peter Kalm, a Swedish botanist. American Laurel.

The Kalmias delight in moist, peaty soil and grow very well in swampy places if planted on low mounds. They are medium or low shrubs with oblong leaves (said to be poisonous to animals) and terminal clusters of showy white, rose or purple flowers. The genus generally requires the treatment of the rhododendron, and dislikes lime or heavy clay soil. Propagation by seed sown in early spring, layering or half-ripe cuttings.

K. angustifolia (Sheep-laurel; Lambkill). A dwarf species, seldom attaining more than 3 ft. in height, with an abundance of purple or crimson blossoms. The leaves are oblong, light green above and whitish beneath. North America.

K. angustifolia var. *candida* has white flowers.

K. angustifolia var. *rubra* bears crimson blooms.

K. glauca (*K. polifolia*). A handsome, low shrub of straggling habit, usually less than 2 ft. high. The flowers, borne in simple terminal umbels, are purplish-rose and abundantly produced in April. Rocky Mountains, North America.

K. latifolia (Calico Bush). An evergreen shrub, growing 8 to 10 ft. high, with large, glossy leaves and terminal sprays of white or rosy (purple-spotted) flowers, of a curious umbrella shape. Mr. W. J. Bean, in *Trees and Shrubs Hardy in the British Isles*, says, 'Both wild and cultivated it is the most beautiful evergreen of the eastern United States.'

LEDUM (Ericaceae) 6 sp. Name from *ledon*, the ancient Greek name of Cistus.

Useful ericaceous, evergreen shrubs for swampy situations in the bog garden. They thrive as well in sunny as partially shaded positions, but dislike lime. The leaves contain a volatile oil with narcotic properties. Propagated by seeds, layers and divisions.

L. latifolium (*L. grælandicum*). The leaves of this plant are reputed to have been used in the American War of Independence as a substitute for tea; hence the popular name, Labrador Tea. It grows about 3 ft. high, with narrow leaves 1 to 2 in. long, and terminal clusters of white flowers. North America.

L. palustre (Marsh Ledum) has linear leaves, rusty beneath, and numerous clusters of white flowers. It grows 1 to 2 ft. high and is found in North America up to Alaska.

LEITNERIA (Leitneriaceae) 1 sp. Named after Leitner, a German naturalist. Corkwood.

L. floridana. A small tree, growing 10 to 15 ft. high, with alternate, oval leaves 3 to 7 in. long and soft and downy beneath. The sexes are borne on different trees, neither being very showy. It requires a wet position and will grow in water. Missouri.

LIQUIDAMBER (Hamamelidaceae) 4 sp. Name from Latin *liquidus*, fluid, and the Arabic *ambar*, amber, in allusion to the fragrant juice which exudes from the tree.

Trees of some value because of the beautiful autumnal tints assumed by the leaves, colours ranging from green and yellow to purple, red and bronzy-black. They are deciduous, with Maple-like leaves, and easily cultivated in a moist soil. Propagated by means of seed.

L. styraciflua (Sweet Gum; Satin Walnut; Alligator Tree) grows 60 to 100 ft. high, with large palmate leaves on stalks 6 to 7 in. long. It is one of the best of the swamp trees, exceedingly handsome in autumn when it appears to be clothed in fire, so vividly bright are the autumn tints. The bark takes on a corky effect which makes it conspicuous in winter, but the round fruits, hanging down like those of the Plane, are rarely produced in this country. The wood is largely imported as satin-wood, for use in furniture making. Eastern States of America.

MYRICA (Myricaceae) 45 sp. Ancient Greek name, thought to have been originally applied to the Tamarisk. Fragrant-foliaged shrubs with inconspicuous flowers and edible fruits; well adapted for moist, bog garden conditions. The bark is astringent and used medicinally, whilst wax is obtained from the fruits of some species. Propagated by seeds, layers and in *M. Gale* by suckers.

M. cerifera (Wax Myrtle). An evergreen shrub, 10 to 15 ft. high, with larger and more serrated leaves than those of *M. Gale*. The globular berries are coated with a white, glistening wax, which is removed by pouring boiling water over them. Candles and tapers made of this wax burn with a resinous fragrance. North America.

M. Gale (*Gale palustris*) (Sweet Gale). A native shrub, growing 4 to 5 ft. high, with lanceolate leaves which are fragrant when bruised; in Yorkshire, branches were once used for flavouring beer. The golden catkins are formed during the summer, remain in character throughout the winter, and expand early the following spring.

OXYCOCCUS (Vacciniaceae) 2 sp. Name from the Latin *oxys*, sharp, and *kokkos*, berry, alluding to the sharp taste of the fruit.

O. macrocarpus (*Vaccinium macrocarpum*) is the American Cranberry, cultivated for its edible fruit. It is of prostrate habit, bearing rounded leaves which are whitish beneath, pink flowers and red, acid berries. North America.

O. palustris (*Vaccinium oxycoccus*) (Small Cranberry). A prostrate evergreen shrub which favours acid, peaty soil, and forms dense masses of creeping stems. The dark green leaves are oval, and clusters of nodding, rosy-pink flowers are succeeded by red, edible fruits. Propagated by seed or layers. North Europe, incl. Britain; North Asia; North America.

POPULUS (Salicaceae) 20 sp. Ancient Latin name, of uncertain origin. Poplar; Aspen.

A genus of short-lived trees of rapid growth and easy cultivation. Planted thickly, they quickly form an excellent wind-break, and grow in most soils, including marshy ground, but resent dry situations.

P. heterophylla (Swamp or Black Cottonwood). A fine swamp species, reaching up to 80 ft. in height. The leaves are downy when young and 4 to 6 in. long. North America.

P. tremula (Aspen) grows 60 to 80 ft. high. The leaves are nearly orbicular, toothed, on long footstalks, and incessantly in motion even when there is no breeze. The red, pendulous catkins are very handsome and appear in March. Europe, incl. Britain; Asia Minor.

QUERCUS (Cupuliferae) 300 sp. Ancient Latin name. Oak. Handsome timber trees, propagated by seed.

Q. bicolor (Swamp White Oak) is one of the finest timber trees for the bog garden. Growing to a height of from 60 to 70 ft. the head is compressed and rounded, the trunk covered with a greyish-brown scaly bark. North America.

Q. palustris (Pin Oak). A handsome tree for a moist position, growing 70 to 100 ft. high, with deeply-cut foliage, which is a decided yellow on opening and later assumes handsome autumnal tints. North America.

Q. Phellos (Willow Oak). A beautiful North American species for moist or swampy, lime-free soil. It grows 60 to 80 ft. high, the elegant, willow-like leaves turning pale yellow in autumn.

RHODODENDRON (Ericaceae) 250 sp. From the Greek *rhodon*, rose, and *dendron*, tree.

The Azaleas are now included under rhododendrons, for botanically they are inseparable. At first sight there appears to be distinctions, especially when one notices that the azaleas are deciduous whilst the others are evergreen; but, if one takes into account the various northern Asiatic species which connect the two great groups, it becomes obvious that they merge into one, with the commonly-known and cultivated azaleas and rhododendrons at opposite ends of the scale. Where azaleas and rhododendrons can be induced to succeed, there can be no more beautiful and appropriate subjects at the water edge. They like a rich, deeply dug, loamy soil with a generous inclusion of leaf mould and

sifted peat; the ground should be moist but well drained and contain no suspicion of lime. For effective plantings the tallest should be placed at the back so that they can be seen when in flower, and the shrubs either be grouped at the water edge or arranged farther to the rear, against a background of conifers, which trees, incidentally, afford them a most advantageous shelter. The plants, forming close balls of earth, are more easily transplanted than most shrubs, and this is noticeable at Chelsea Flower Show, when one sees them freely used in the formal gardens or arranged amongst the tent exhibits.

The genus has little economic value. The wood of some species is used as fuel or for turnery purposes, and the leaves employed medicinally. Honey obtained from the flowers is believed to be poisonous, although in India a subacid jelly is prepared from the flowers of various kinds. Propagation, by layers, seed and various methods of grafting. The skill of the hybridiser has not left the rhododendron undisturbed, and there are now many beautiful varieties at the gardener's disposal. The study of a shrub nurseryman's catalogue will afford a selection of the newest and finest varieties, in colours ranging from white and blush to yellow, orange, cherry-red, rose, scarlet, purple, crimson and pink, including many bicolors.

RUBUS (Rosaceae) 225 sp. Latin name from *ruber*, red.

R. arcticus has trifoliate leaves, and rose-coloured flowers followed by amber, edible fruits. North America.

R. Chamæmorus (Cloudberry; Bakeapple Berry; Yellow Berry). A pretty, low-growing shrub for ground cover, with alternate rounded leaves and white flowers succeeded by globular, red or yellowish fruit. It is an inhabitant of peat bogs in Europe, Asia and North America.

R. pubescens (*R. americanus*; *R. triflorus*), being of creeping, trailing habit, makes a useful cover plant in the bog garden. It has thin, delicate foliage, small white flowers and reddish berries. North American swamps.

SALIX (Salicaceae) 160 sp. Derived from an ancient Latin word meaning 'to spring', in allusion to the rapid growth of the genus. Willow.

The Willow has a natural affinity for water, and perhaps no tree suggests itself as being more suitable for streamside plantings. It thrives in all soils, providing only that they be moist enough;

and varies from the alpine species, which are only a few inches high, to tall and elegant trees. In addition to its decorative feature, the plant absorbs and transpires enormous quantities of water, for which reason it is sometimes planted near cesspools for its sanitary effects, and various species are used for their services in fixing river banks against erosion.

The osiers make excellent basket material and have been in vogue since earliest times; the ancient Britons were skilful in weaving them and from their lightness found them useful for their coracles. Many woods are employed in the manufacture of charcoal—principal ingredient of gunpowder—but that of the willow is better than any, with the result that trees are grown for this purpose in many parts of England. They are also used for cricket bats, and the leaves, being astringent, can be used for tanning and medicinal purposes. The brilliant-coloured barks of some species are of value for their winter effects; such varieties should be severely cut back early in the year, as it is only the young wood that displays the feature.

Suitably planted, and in a fitting position, the Weeping Willow creates elegance and beauty at all seasons of the year; it should be planted singly, with careful consideration as to background and surroundings. The sexes are usually on separate plants, the bright yellow 'pussy' catkins of some species being particularly decorative in early spring. Willows are easily propagated by cuttings.

S. babylonica (Babylonian Weeping Willow; Napoleon's Willow). A tree of weeping habit, not as beautiful as *S. vitellina* var. *pendula*. It grows 20 to 30 ft. high, with olive-green or purplish branches. China.

S. Caprea. The common Goat or Palm Willow, whose golden catkins are so familiar in early spring. It grows 12 to 15 ft. high. Europe, incl. Britain; Asia.

S. Caprea var. *pendula* (Kilmarnock Willow) is a dwarf form, growing only about 4 ft. high, and of weeping habit, the long branches spangled with gold and silver catkins in early spring.

S. cœrulea (Cricket-bat Willow). A quick-growing variety with dark green foliage, having an ashen-grey reverse. It is a natural hybrid between *S. alba* and *S. fragilis*. Britain.

S. daphnoides (*S. pruinosa*) (Violet Willow). A handsome species, with violet-purple stems which are overlain with a bluish bloom during the winter months. Europe.

S. pentandra (*S. laurifolia*) (Bay or Laurel-leaf Willow). An unusual Willow with broad, shining, dark green, laurel-like leaves. It grows 10 to 18 ft. high. Europe; Asia.

SPIRAEA (Rosaceae) 50 sp. Name derived from the Greek *speira*, a band or wreath; a plant used for garlands.

A genus of easily grown, ornamental, deciduous shrubs for the waterside, with plumes of pink, white, cream or crimson flowers. They should be planted in a moist position and are not particular as to soil. Propagation by division or suckers.

S. Aitchisonii (*Sorbaria angustifolia*). A bamboo-like shrub, growing 6 to 8 ft. high, the stems often bright red when young. It carries attractive fern-like foliage and immense panicles of pure white flowers. Afghanistan; Kashmir.

S. arborea (*Sorbaria arborea*). A Chinese shrub growing 10 to 20 ft. high, with large pinnate leaves and creamy-white plumes of flowers.

S. arborea var. *glabrata* is similar to the type, but with purple leaf-stalks and branches.

S. arguta. A spring-flowering hybrid from *S. Thunbergii* and *S. multiflora*, with white flowers. It is of vigorous constitution, quite hardy and one of the freest flowering.

S. bracteata (*S. nipponica*) grows 8 ft. high, with showy umbels of pure white flowers and dark green foliage. Japan.

S. canescens (*S. cuneata*; *S. flagelliformis*; *S. rotundifolia*). A very graceful and elegant Himalayan shrub, suitable for a sheltered spot in the water garden. The flowers are borne in dense, white corymbs and spangle the whole length of the branches.

S. discolor (*Holodiscus discolor*) has drooping panicles of creamy-white flowers. North America.

S. japonica (*S. callosa*). The type has loose corymbs of deep pink flowers and pale bluish-green leaves. There are, however, many varieties, including the following: Anthony Waterer, bright crimson; *atrosanguinea*, crimson, with ruby-red foliage; *Fortunei*, purplish; var. *variegata*, with variegated leaves.

S. salicifolia (Bridewort). An upright shrub favouring low, wet ground. It bears panicles of light pink or whitish flowers.

TAXODIUM (Coniferae) 2 sp. From *taxus*, the yew, and *eidos*, like; trees resembling the yew.

T. distichum (Bog Cypress). A handsome deciduous tree of pyramidal habit, which will grow 100 to 150 ft. high with a trunk

4 to 6 ft. in diameter. It will flourish in very wet situations; there is one at Kew thriving in a lily-pond, and produces fine feathery foliage. This is delicate green in spring, but in autumn assumes reddish-brown tints. Male and female flowers are separate but on the same tree. Southern United States.

VACCINIUM (Ericaceae) 150 sp. (which includes the Oxycoccus sometimes referred to this genus). The old Latin name of the Blueberry.

A genus of attractive shrubs, mostly inhabitants of acid and peaty bogland; they do not care for lime and often will not grow in rich soil. Many have bright and attractive berries of an edible nature. Propagation by division and cuttings.

V. Myrtillus (Whortleberry; Bilberry). A native shrub with edible fruits, which are sometimes offered for sale in country towns. It has thin, oval, shining leaves; pale-pink, bell-shaped flowers and black berries with a bluish bloom. Height 6 to 12 in. North and Central Europe, including Britain.

V. Vitis-Idæa (Mountain Cranberry; Cowberry; Partridge Berry). A low, evergreen, creeping shrub, 6 to 10 in. tall, with wiry stems thickly covered when young with a black down. It has small, box-like leaves, white or rose bell-shaped flowers and acid, dark red fruits. In northern Canada, trappers and Indians have frequently to depend upon these berries for food. Europe, incl. Britain; Northern Asia; North-East America.

WISTARIA (Leguminosae) 5 sp. Named after Caspar Wistar (1761-1818), professor of anatomy in the University of Pennsylvania.

Wistarias like a deep, rich soil and plenty of sunshine; easily effected even in poor ground by sinking a bottomless tub deep into the ground, filling it with good soil and planting the root in the centre. Propagation by root and hardwood cuttings, seed, and root and stem graftings.

W. floribunda (Japanese Wistaria) has violet-blue flowers hanging on racemes 3 to 5 in. long. It is very hardy and later flowering than *W. sinensis*. Japan.

W. floribunda var. *macrobotrys* (*W. multijuga*) is much prized for the exceptionally long trusses of lilac flowers, these being often 1 to 3½ ft. long.

W. floribunda var. *Russeliana* is similar to preceding, but with deeper-coloured flowers.

W. sinensis (*W. chinensis*). The most popular species, with abundant trusses of pale mauve flowers during May and June. By keeping the plant dwarf, *i.e.* pruning it back to two or three buds in August, it becomes particularly floriferous and a joy to behold. China.

W. sinensis var. *alba* has white flowers.

W. sinensis var. *alba plena*, with double, white flowers, is not so free-flowering.



HOSTA GLAUCA (FUNKIA SIEBOLDII) AND IRIS KAEMPHERI



HELONIOPSIS BREVISCAPA



A GROUP OF *HEMEROCALLIS FLAVA*



IRIS LAEVIGATA



GUNNERA MANICATA, THE MOST IMPOSING OF ALL
WATER-SIDE PLANTS



GUNNERA MANICATA AND IRIS KAEMPHERI AT WISLEY



ABUNDANT LILIES GIVE A TROPICAL AIR OF LUXURIANCE AT THE STREAMSIDE

CHAPTER XVI

Hardy Plants for the Bog and Waterside

Each painted floweret in the lake below
Surveys its beauties, whence its beauties grow;
And pale Narcissus on the bank, in vain
Transformed, gazes on himself again.

ALEXANDER POPE.

IT WILL add much to the beauty of the pool if the surround is furnished with certain of the following waterside plants, some of which should be grown as much for their beauty of flower as for their handsome foliage. The artistic scheme is one of informality: so plant them in clumps with a designedly haphazard air, which yet displays in an unrestricted way the charms of each colony. Hereabouts, in the lush richness of the bog garden, may be reared some of the most beautiful plants in all the world, unknown to many cultivators, and averse from growing under any other conditions. It would be an extensive garden, indeed, that could accommodate all the plants we mention, but from this list the gardener will be able to select such subjects as will make his pond a veritable delight.

ACHILLEA (Compositae) 100 sp. Ancient Greek and Roman name, derived from that of Achilles, hero of the Trojan war.

A. Ptarmica. The species grows about 1 to 3 ft. high and has linear-lanceolate, toothed but not deeply divided leaves, and heads of white flowers. Europe, incl. Britain.

A. Ptarmica var. *Perry's White* is a good double-flowered form, with larger blooms than the other double forms (The Globe and Boule de Neige). All are propagated by division.

ACONITUM (Ranunculaceae) 110 sp. From Greek *Akoniton*, name applied to a plant of uncertain identity, used for poisoning wolves, etc. Monkshood; Wolfsbane.

A genus of hardy perennials favouring rich, moist soil, and easily naturalised beside streamlets or in shrubberies. The beautiful deep blue flowers of some species contrast pleasingly with the yellows of Rudbeckias and Hemerocallis, or the soft shades of Hostas: but, owing to their poisonous nature, one

should be extremely careful not to plant where there is the slightest risk of the roots being dug by mistake for culinary purposes. The drug aconite is the dried root of *A. Napellus*; it contains the intensely poisonous alkaloid, aconitine; the leaves are also used medicinally. The plants are much confused as to names in both gardens and herbaria. Propagation is effected by division of the roots in spring or autumn, or by seed.

A. autumnale. An autumn-flowering species, growing 3 to 5 ft. high, with pale blue flowers and lobed leaves. North China.

A. chinense (*A. Fischeri* of gardens) has sky-blue, helmet-like flowers on short spikes and handsomely-cut, shining, palmate foliage. Height 2 to 3 ft. China.

A. longibracteatum var. *album*. A late summer-flowering variety, growing 3½ ft. high, with slender spikes of silvery-white flowers.

A. Lycoctonum. A vigorous, yellow-flowered species reaching 3 to 6 ft. in height. Europe; Siberia.

A. Napellus. The best known species and the one most extensively used in medicine. Erect stems, 3 to 4 ft. high, bear narrowly divided leaves and racemes of blue flowers. Europe.

The British representative of the collective species, *A. Napellus*, is now given independent rank as *A. anglicum*. It grows wild here and there along rivers and mountain brooks and in marshy woods in the south-west and west of England: and is distinguished from other members of the group by its early flowering season (May-June), the light green foliage and dense, simple racemes of mauvish-blue flowers.

A. paniculatum grows 3 ft. high, with deeply-cut, dark green foliage and violet-blue flowers. Europe.

A. volubile is a distinct plant of climbing habit, the slender, twining stems bearing rich blue flowers. Height 4 ft. Siberia.

A. Wilsonii. A vigorous-growing plant of recent introduction, growing 6 ft. high, with large violet-blue flowers.

ACTAEA (Ranunculaceae) 15 sp. Ancient Latin name (from Greek *Akte*) of the Elder (*Sambucus nigra*), transferred by Linnaeus to this genus. Baneberry.

Vigorous-growing plants thriving in rich soil and shade. The showy spikes of flowers somewhat resembling *Cimicifuga* appear in spring, and are succeeded by handsome white and red berries. Propagated by division in spring, or by seed sown directly after ripening.

A. alba (White Baneberry). A handsome plant growing 12 to 18 in. high, with graceful racemes of white flowers and fruits and having bright red foot-stalks. North America.

A. spicata (Cohosh, Herb-Christopher) has serrated leaflets, white flowers and purplish-black fruits. The roots are astringent and reputed to give relief with catarrh, whilst the berries, which are poisonous, yield, with alum, a black dye. Height 2 ft. Europe;

A. spicata var. *rubra*. Taller than the type, with showy scarlet berries. North America.

ACTINIDIA (Actinidiaceae) 26 sp. Name derived from *aktis*, a star, referring to the radiating styles.

Climbing, deciduous shrubs cultivated for their brightly-tinted foliage, small waxen flowers and, in some cases, edible fruit. They prefer a moist, rich soil in a sheltered position. Propagated by layers, ripe and half-ripe cuttings.

A. arguta (*A. rufa* var. *arguta*). A free-growing climber, with small, waxy, white flowers, large, oval leaves and sweet, greenish-yellow berries. Japan; Manchuria; Korea.

A. Kolomikta should be grown against a tree upon which it can support itself; the ovate leaves are handsomely variegated in white and pink whilst the flowers are white: the fruit becomes black. China; Korea; Japan.

A. polygama grows to a great height in favourable positions, even to the tops of tall trees. The flowers are white and fragrant, the leaves variegated in white or silver, and the oblong fruit is yellow. Japan; China; Korea.

AJUGA (Labiatae) 30 sp. Derivation doubtful; Bugle Weed.

Hardy perennials, usually of creeping habit, useful for carpeting moist pasture ground. The plants have some medicinal properties. Propagated by division.

A. genevensis (*A. alpina*; *A. rugosa*) is not of stoloniferous habit and bears erect spikes 6 to 9 in. high, densely covered with deep blue nettle-like flowers. The leaves are small, dark green and oblong in shape. North temperate regions.

A. reptans. The common Bugle of English woodlands.

A. reptans var. *alba* carries white flowers.

A. reptans var. *rubra* bears dark purple leaves and spikes of blue flowers: it is much finer than the type.

A. reptans var. *variegata* has yellow variegated foliage.

ALETRIS (Liliaceae) 3 sp. From *aleton*, meal; the whole plant appears to be covered with a mealy dust. Star Grass.

A. farinosa forms thin, grassy tufts, from the centre of which emanate spikes of white bell-shaped flowers about $\frac{1}{2}$ in. in length. The roots are very brittle and used medicinally. The plant favours moist, deep, peaty soil with partial shade and grows 2 ft. high. Propagated by offsets. North America.

ALLIUM (Liliaceae: put by Hutchinson in Amaryllidaceae) 300 sp. Ancient Latin name of the onion.

A. angulosum (*A. acutangulum*). A tuft-forming species, with narrow, mostly basal leaves and angled stems, 1 to 2 ft. high, ending in many-flowered umbels of rose blooms. Propagated from seed. Europe and N. Asia.

ANAGALLIS (Primulaceae) 25 sp. Ancient Greek name for the scarlet pimpernel (*Anagallis arvensis*).

A. tenella (Bog Pimpernel). A beautiful little creeping native plant, forming dense carpets of tiny leaves spangled with soft rosy-pink flowers. It makes a pretty bog subject at the edge of the water. Propagated by division or seed.

ANEMONE (Ranunculaceae) 120 sp. Ancient Greek name supposed to mean 'daughter of the wind' because the flowers grew in windy places.

A. rivularis. A handsome plant for naturalising at the waterside, growing about 2 ft. high and carrying loose umbels of snow-white flowers with violet anthers. Himalayas.

A. virginiana. A stout, hairy plant, growing 2 to 3 ft. high, with white or greenish flowers about $1\frac{1}{2}$ in. across. Actual flooding will not damage this species. Eastern North America.

ARNICA (Compositae) 50 sp. A mediaeval name of doubtful origin, possibly Arabic, but sometimes supposed to be from the Greek *arnos*, lamb.

A. Chamissonis (Lamb's Skin). A pretty species for a moist, sunny position, with hoary foliage and bright golden flowers. Height 12 in. North America.

A. montana (Mountain Tobacco or Snuff) is suitable for the drier parts of the bog garden. It forms neat tufts of light green foliage and carries three or four large heads of orange flowers. Tincture of arnica is prepared from all parts of the plant. Propagation by division. Height 12 in. Europe.

ARUNCUS (Rosaceae) 6 sp. Old name. Goat's Beard.

A. sylvestris (Spiraea Aruncus). A noble plant for the waterside, with quantities of dark, divided foliage and heavy plumes of creamy-white flowers. It prefers a rich soil in half-shady positions and is reproduced by division. Europe; N. Asia; North America.

ASCLEPIAS (Asclepiadaceae) 160 sp. Ancient Greek and Latinised name. Milkweed.

A. incarnata (Swamp Milkweed). A good waterside plant growing 3 ft. high, with stout, leafy stems and umbels of rosy-pink flowers. Propagated by division. North America.

A. incarnata var. *alba* bears white flowers.

A. incarnata var. *pulchra* bears dull red flowers and has broader foliage than the type.

ASTER (Compositae) 500 sp. From *aster*, a star. Starwort; Aster; Michaelmas Daisy.

A. junceus (Rush Aster). A slender species, some 2 to 3 ft. high, with slight, grassy leaves and heads of violet—or occasionally white—flowers. It will grow in real bogland or even in shallow water. North America.

A. nemoralis (Bog Aster). A fine bog perennial, growing 6 to 24 in. high, with heavy heads of large violet-purple to rose-pink flowers. North America.

A. paludosus (Southern Swamp Aster) grows 18 to 30 in. tall, with rough, linear leaves and large, deep violet, daisy-like flowers. E.N. America.

A. puniceus (Red-Stalked Aster; Swanweed) grows 3 to 5 ft. high, with stout, reddish stems, lanceolate leaves and spreading heads of violet-purple blossoms. It makes a good swamp plant and is quite hardy.

A. Tripolium (Sea-Aster). A succulent, native plant, growing 2 to 3 ft. high, carrying long, smooth, fleshy leaves and corymbs of small purplish flowers having yellow centres. It will grow in soil or salt marshes but is not very ornamental.

Many of the *novae-angliae* and *novae-belgii* forms (which are partial to moisture) may be grown for their autumnal effects close to the water garden.

ASTILBE (Saxifragaceae) 20 sp. Name coined by Buchanan Hamilton and in 1825 published by David Don without explanation. In 1834, David's brother, George Don, explained it as from the Greek *a*, without, and *stilbe*, brightness; its aptness is not apparent.

Ideal herbaceous perennials for the waterside: the handsome foliage makes good undergrowth over which the feathery panicles of pink, crimson or white flowers show to good effect. They like plenty of water during the growing season but are not fussy as to soil. The genus is often confused with *Spiraea* and *Aruncus*. Propagated by division.

A. Arendsii. A series of hybrids of *A. Davidi* with various other species (*A. astilboides*, *A. japonica* and *A. Thunbergii*) raised by George Arends and others, the following being among the best:

Betsy Cuperus, pink and white. $2\frac{1}{2}$ ft.

Bremen, salmon-crimson. $2\frac{1}{2}$ ft.

Fanal, brilliant red. $2\frac{1}{2}$ ft.

Gertrude Brix, crimson. 3 ft.

Granat, dark crimson. $3\frac{1}{2}$ ft.

Gunther, bright pink. 3 ft.

Koning Albert, white. 6 to 7 ft.

Silver Sheaf, silvery-white. 3 ft.

A. biternata (*A. decandra*). Often confused with *Aruncus sylvestris* (*Spiraea Aruncus*), this is a stronger plant, growing 3 to 5 ft. tall, with branched spikes of yellowish-white flowers. North America.

A. crispa (*A. hybridum crispa*). A hybrid suitable for a damp spot in the rock garden, with very low, dark green, crinkled leaves and masses of pink and white flowers about 4 to 6 in. high: it was found by George Arends among his hybrid seedlings and may have arisen from the crossings of *A. simplicifolia* with an *A. Arendsi* seedling.

A. Davidi. A handsome Chinese species with coarsely-cut leaves and panicles of bright rosy-purple flowers, often 2 ft. long. Height 4 to 6 ft.

A. grandis. Another Chinese species, with yellowish-white flowers on long, branching panicles.

A. japonica (*Hoteia japonica*; *Spiraea japonica*). A well-known species, often used for forcing, with dark foliage and white plumes of flowers. Height 1 to 3 ft. Japan.

A. rivularis is of airy habit: a useful associate of other broad-leaved subjects. It grows 3 to 5 ft. tall from a rhizomatous rootstock, with deeply-divided leaves and slender spikes of creamy-white flowers. W. China; Himalayas.

A. rubra. A beautiful plant with long, hairy stems, 4 to 6 ft. high, sharply-cut leaves and numerous panicles of rose and deep red flowers. India; Japan.

A. simplicifolia. A dwarf Japanese species with glossy foliage and short panicles of creamy flowers. Height 9 in. Many graceful hybrids have been raised from this by Arends.

A. simplicifolia var. *rosea* is similar to the type but with rosy flowers. There is also a white and pale pink form.

A. Thunbergii is a graceful Japanese species for waterside planting, growing about 2½ ft. high, the white clusters of flowers borne on reddish stems. It is of bold, erect habit and does well in shady situations.

ASTRANTIA (Umbelliferae) 10 sp. From Greek *astron*, a star, and *anti*, against, *i.e.* compared with, in allusion to the star-like appearance of the umbels. Masterwort.

The Masterworts are perhaps not strikingly handsome plants, yet they possess a quaint charm of their own and make interesting subjects for the garden. They like plenty of moisture and show a partiality for lime in the soil, although the latter is not absolutely necessary for their well-being. Of erect growth, with handsome lobed foliage and aromatic roots, the umbels are borne aloft on slender stems and consist of a circle of white or rose, green-veined chaff-like bracts enclosing a disc of tiny rose-pink flowers. Propagation by seed or division of the roots in spring or autumn.

A. carniolica (*A. maxima*; *A. helleborifolia*) grows 12 in. high, and is a frail-looking plant carrying blush-rose flowers with green and white striped bracts. S.E. Europe.

A. major thrives by running water and in partial shade. It grows 2 ft. high with curious pink and green flowers and has five-lobed leaves. Europe.

A. minor with milk-white blossoms is only a few inches high. Switzerland.

BIDENS (Compositae) 150 sp. Name in Latin meaning two-toothed, referring to the seeds.

B. involucrata (*Coreopsis involucrata*) (Tickseed Sunflower). An annual growing 1 to 3 ft. high, the very branched stems carrying narrow, toothed leaves and large, orange, coreopsis-like flowers. Suitable for swamps and wet pasture land. Propagated by seed. North America.

B. laevis (Brook Sunflower). A North American annual which

will seed itself naturally in very wet ground. Growing 1 to 2 ft. high, it bears serrated, lanceolate leaves and numerous heads of very showy, golden-yellow flowers, each 2 to 3 in. across.

BOCCONIA (Papaveraceae) 5 sp. Named after Paolo Bocconi (1633-1703), a Sicilian botanist and author. The true Bocconias are trees and shrubs native to Central and S. America. The herbaceous Bocconias are now put in a distinct genus **MACLEAYA** (which see).

BOLTONIA (Compositae) 4 sp. Named after James Bolton (died 1799), an English botanist who wrote on ferns and fungi. False Chamomile.

B. decurrens. A stout perennial for wet situations, with lanceolate leaves 3 to 6 in. long, and branched heads of white, violet or purple, daisy-like flowers. Unlike some of the genus the plant does not need staking. Propagated by division. North America.

BULBINELLA. See **CHRYSOBACTRON**.

BUPHTHALMUM (Compositae) 4 sp. Greek name (*Bouphthallon*) for ox-eye, applied to a species of chrysanthemum.

B. speciosum (*Telekia speciosa*) is a robust perennial with large, showy, yellow flowers, having dark centres, and coarsely-serrated, cordate leaves. It attains a height of 4 to 5 ft. and is propagated by division in spring or autumn. An excellent plant for forming bold masses, it grows so closely as to keep the weeds down, and flourishes in almost any soil. Europe.

CALTHA. See page 92.

CAMASSIA (Liliaceae) 5 sp. From *Quamash*, the Indian name. North American bulbous plants, invaluable for cutting: the bulbs of some species being eaten by the Indians for food. They like a moist situation, very wet in winter and spring but dry in summer: in their native habitat the bulbs are often under water at flowering time. Plant them 3 to 6 in. deep and let them remain undisturbed. Propagation by means of seed or division of the bulbs.

C. hyacinthina (*C. Fraseri*; *C. esculenta* of B. L. Robinson) grows from 12 to 18 in. high, bearing loose racemes of light blue flowers about 1 in. across, with evenly spaced segments. The foliage is something like that of a bluebell. Found by streams and marshes in Eastern North America.

C. Leichtlinii. A robust species, growing 3 ft. or more in height, with large, sometimes compound, flower-spikes containing many

large creamy-white flowers, the segments of which converge and become twisted together as they wither. This is undoubtedly the finest member of the genus: in Mr. Bowles' garden it thrives luxuriantly in a wet meadow with *Calthas*, seeding freely. British Columbia.

C. Quamash (*C. esculenta* of Lindley). A robust species, growing about 2 ft. high, with large dark blue flowers, the irregularly spaces segments of which are twisted and wither independently. Western North America.

CAMPANULA (Campanulaceae) 300 sp. From Latin *campana*, a bell, alluding to the shape of the flowers.

C. rotundifolia (Hairbell; Blue Bells of Scotland) is a charming subject for naturalising in moist parts of the garden. In shady woods it grows as much as 2 ft. high, with slender stems of bright blue bell-shaped flowers. Europe, incl. Britain; North America; Siberia.

C. rotundifolia var. *soldanellæflora* is unique in that the petals are cut and fringed the whole of their length.

CARDAMINE (Cruciferae) 100 sp. Greek name of a cress.

Dainty spring-flowering perennials, Tennyson's 'faint sweet cuckoo flowers' are particularly suitable for the lower parts of the bog garden. They are of easy cultivation and propagated by division.

C. bulbifera has purple flowers. Britain.

C. pratensis. The common Lady's Smock of our English meadows with rosy-lilac flowers. The cress-like leaves were formerly used in salads. The double form, var. *plena*, is infinitely to be preferred and grows 6 to 9 in. high. The leaves take root and bud off young plants.

C. trifolia has white flowers and grows 6 to 12 in. in height. Switzerland.

CHAMAELIRIUM (Liliaceae) 1 sp. Name from the Greek *chamai*, ground, and *leirion*, lily; signifying a dwarf or low lily.

C. luteum (Blazing Star; Wand Lily). An erect, tuberous-rooted plant, growing 12 to 15 in. tall, with tufts of plantain-like foliage and slender spikes of yellowish-white flowers. It is a good perennial for moist, shady positions. North America.

CHELONE (Scrophulariaceae) 4 sp. From the Greek for turtle, the head of which the corolla resembles; the early French settlers in N. America called the plant 'La Tortue'. Turtle-head.

Handsome North American perennials which flower in late summer. They succeed best in swampy land and are propagated by seed, divisions or cuttings.

C. glabra (*C. obliqua* var. *alba*) (Cod-head; Snake-head) grows about 2 ft. tall and has white or rose-tinged flowers. N. America.

C. Lyoni grows from 2 to 3 ft. high, forming dense masses of nearly cordate leaves which are broadest below the middle, and has terminal heads of reddish-purple flowers. North America.

C. obliqua (Red Turtle-head) generally flowers earlier than the preceding and has reddish-purple flowers; the leaves are widest about the middle. Height 2 ft. North America.

CHRYSANTHEMUM (Compositae) 180 sp. Greek, meaning golden flower.

C. lacustre (Marsh Ox-Eye Daisy). A good plant to naturalise in swampy places in the wild garden if only for the value of the cut flowers. The blooms are almost identical with those of *C. maximum* and the plant grows about 2 ft. tall. Portugal.

C. uliginosum (*Pyrethrum uliginosum*; *C. serotinum*) (Giant Daisy) needs a very moist soil and grows 4 to 5 ft. high, the white flowers $2\frac{1}{2}$ to 3 in. across and the foliage rather rough and sharply toothed. Hungary.

CHRYSOBACTRON (Liliaceae) 2 sp. Name from the Greek, meaning golden wand.

C. Hookeri (*Bulbinella Hookeri* now the accepted name). An interesting plant for the drier parts of the bog garden, with reddish-green, sword-like foliage and stout spikes of small, star-like, golden-yellow flowers. A peculiarity of the species is the extreme brittleness of the roots, they are as fragile as glass, so great care must be exercised when planting. Height 2 ft. Propagated by division or seed. New Zealand.

CHRYSOSPLENIUM (Saxifragaceae) 60 sp. Name from the Greek *chrysos*, gold, and *splen*, the spleen, from the yellow blooms and some reputed medicinal quality.

C. americanum (Golden Saxifrage; Water Carpet) is of little value except for carpeting wet, muddy places where some cover is wanted. It is a succulent, semi-aquatic plant having small green leaves, and tiny, clustered, purplish-yellow flowers with orange-red stamens. North America.

C. oppositifolium. A native plant, growing some 6 in. high, with abundance of bright green, tender foliage and terminal, flat clusters

of yellowish-green apetalous flowers. In the Vosges the leaves are used for salads under the name of Cresson de Roche. It flowers in April and May and is propagated by division. Europe, incl. Britain.

CIMICIFUGA (Ranunculaceae) 12 sp. From *cimex*, a bug, and *fugere*, to fly, indicating certain virtues of the plant. Bugbane.

Although not, strictly speaking, bog plants, the *Cimicifugas* make excellent background subjects for the shadier parts of the wild garden, the dark green, divided foliage and erect, creamy spikes of flowers rendering them exceedingly handsome. Propagation is effected by division of the roots in spring or autumn.

C. cordifolia. A tall species with creamy-white flowers, thriving in any good garden soil, and very similar to the well-known *C. racemosa* but flowering later. North America.

C. dahurica grows taller than the preceding and has blackish stems with branched spikes of creamy-white flowers. It is inferior to the *racemosa* forms. Manchuria.

C. racemosa. A handsome species, growing from 3 to 8 ft. high, with densely-clothed spikes of snow-white flowers and dark green leaves; it is in bloom from August until the end of September. The rhizomes and roots are used in medicine. North America.

C. racemosa var. *Avalanche*. A charming September-flowering variety of recent introduction, bearing long, feathery plumes of snow-white flowers. Height 3 ft.

C. simplex (*C. racemosa* var. *simplex*). A tall and handsome plant from Japan, growing 3 to 4 ft. high, with feathery plumes of creamy-white flowers. Unfortunately, the inflorescences of *Cimicifugas* often have a strong, unpleasant odour, although this is not apparent unless the plants are handled.

CLAYTONIA (Portulacaceae) 24 sp. Named after John Clayton (1686-1773) of Virginia, one of the earliest American botanists. Spring Beauty.

C. sibirica requires real bog garden treatment. It is a pretty little plant with pink flowers.

C. virginica. A slender, erect plant with loose racemes of pink blossoms and linear leaves, arising from a deep, tuberous root-stock. The herbage boiled makes an excellent substitute for spinach. Height 2 to 6 in. Moist woods of North America.

CLINTONIA (Liliaceae) 6 sp. Named in honour of De Witt Clinton (1769-1828), American naturalist.

Moist woodland subjects suitable for shady positions at the back of the bog garden. Propagation by division.

C. Andrewsiana. The prettiest of the genus, with numerous pale green leaves about a foot long by 4 in. wide, and dense umbels of deep rose blossoms. It likes a moist, clayey soil and grows about 18 in. tall. California.

C. borealis has hairy, light green, plantain-like foliage and three or four nodding, greenish-yellow flowers arranged in an umbel. These are succeeded by oval, blue berries. Height 1 ft. North America.

COPTIS (Ranunculaceae) 19 sp. From Greek word meaning to cut, because of the divided leaves.

C. trifolia (Helleborus trifolius) (Gold-thread). A pretty little evergreen bog plant, growing 3 to 6 in. high, with shiny, trifoliate leaves and slender scapes of small white flowers. The yellow, bitter rootstocks yield a yellow dye and a valuable tonic medicine. The plant is easily grown in the moist parts of the bog garden and is reproduced by division. North America.

COREOPSIS (Compositae) 114 sp. Greek, signifying bug-like, from the shape of the fruit.

C. rosea (Pink Tickseed). A slender perennial, growing 1 to 2 ft. high, with narrow, grassy leaves and branching stems profusely covered with rose-coloured flowers, each about 1 in. across. It is suitable for an open, swampy position. Eastern North America.

CORNUS (Cornaceae) 60 sp. See also page 227.

The two following herbaceous species are sometimes put in a genus *Chamaeperidymenum*, distinct from Cornus.

C. canadensis (Bunch-berry). A beautiful little North American woodland plant, forming carpets of broad, light green foliage dotted over with silver-white flowers. Scarlet berries follow the blooms in autumn. Height 3 to 9 in.

C. suecica (Dwarf Cornel). A good associate for the preceding, growing 4 to 10 in. high, with pale green foliage and dark purple flowers about 1 in. across. The fruits are red. Native to the cold, wet woodlands of Arctic America.

DIANTHUS (Caryophyllaceae) 250 sp. From the Greek *Dios anthos*, flower of Jupiter.

D. superbus. Possibly the only species which does not mind a damp situation. It grows 1 to 2 ft. high and has large purplish-

rose flowers, with the petals very deeply and irregularly slit into narrow strips. Norway to Japan and Spain.

DODECATHEON (Primulaceae) 30 sp. A Greek name *Dodektheon*, applied by Pliny to a plant with seven lettuce-like leaves springing from a yellow root, which was considered to be under the guardianship of the higher gods and a cure for ills of all kinds. Linnaeus in 1751 transferred the name to this genus. Shooting Star; American Cowslip.

A charming genus of spring-flowering perennials with cyclamen-like blooms and compact rosettes of foliage. They will grow quite easily in similar situations to Primulas, *i.e.* moist, fairly rich soil and a shady or half-shady position. Propagation by division of the roots in early spring or by seed.

D. frigidum has violet flowers. Western North America.

D. Hendersonii grows about 12 in. high, with small, elliptical leaves about 1 in. in length, and a few purple and yellow cyclamen-like flowers. California.

D. Meadia. A robust plant, growing 12 to 18 in. high, with slender stems bearing umbels of magenta, drooping flowers, the petals turned up and backwards as in the cyclamen. The long green leaves are freely spotted with purple. Eastern North America.

D. Meadia var. *Brilliant* is a greatly improved form of the type with deep rose-crimson flowers. Height 15 in.

D. radicum bears pinkish flowers with purple anthers. North America; Colorado and New Mexico.

DONDIA. See HACQUETIA.

EPIGAEA (Ericaceae) 2 sp. Name from the Greek *epi*, upon, and *gaia*, earth, alluding to the prostrate form of growth.

E. repens (Trailing Arbutus; Mayflower). A beautiful little evergreen that forms dense patches of dark green foliage, carrying clusters of white or rose-tinted flowers with a delicious spicy foliage. It thrives in the same acid, peaty soils as the marsh orchids and, like them, depends on mycorrhizal fungi for nutrition. It dislikes lime. Propagation by seed, division or layers.

EPILOBIUM (Onagraceae) 200 sp. Name from the Greek *epi*, upon, and *lobos*, a pod, because the flower is borne upon the ovary. Willow Herb; Fire Weed; Rose-bay.

Showy plants for the wild garden, but too weedy to be introduced indiscriminately, as underground runners cause the plant

to spread rapidly and it also seeds freely. The coma of the seeds has been used for lamp wicks in Lapland and also spun—with poor success—into cloth. According to Haller, the young shoots of *E. angustifolium* make a pleasant vegetable, although an infusion of the plant stupefies; whilst the pith, being dried and boiled, becomes sweet and is made into ale and vinegar by the Kamtschatchaks. Goats, cows and sheep are said to eat it as fodder, and the down of the seeds mixed with fur is made by the Lapps into stockings and other clothing.

E. angustifolium (*Chamaenerium angustifolium*) grows 3 to 5 ft. high, with willow-like foliage and spikes of single, rosy, sweet-smelling flowers. Europe, incl. Britain; Asia; North America.

This species divides into main varieties, var. *macrocarpum*, with pods $2\frac{1}{2}$ in. long, which is widely distributed as a wild plant in Britain, and var. *brachycarpum*, with 1 in. long pods, which is the taller sort and the one commonly cultivated and occasionally naturalised.

E. angustifolium var. *album* has white flowers and is of more compact habit. It occurs wild in Britain.

ERICA (Ericaceae) 500 sp. From the Greek *Ereike*, a kind of heather.

Many of the heaths can be introduced with charming effect in the boggy parts of the garden, and on rocky banks or sloping mounds form their own adornment. Amongst those suitable for such positions are the rosy-flowered *carnea* and its white counterpart var. *alba*; *vagans*, the purple Cornish Heath; *Tetralix*, the pink Bell Heather and *mediterranea* which shows all shades from deep red to white.

ERYNGIUM (Umbelliferae) 220 sp. From *Erungion*, the old Greek name for the genus.

E. aquaticum (Rattlesnake-master; Button Snakeroot). A stout plant, growing 2 to 6 ft. high, with long, linear leaves which have very prickly margins. The flowers are borne on branching stems and consist of round, tightly packed, blue thistle heads. The roots were at one time candied for sweetmeats. Eastern United States.

EUPATORIUM (Compositae) 450 sp. Name from Mithridates Eupator, ancient king of Pontus who is said by Pliny to have used the plant in medicine. Joe Pye Weed; Hemp Agrimony.

Coarse perennials with some medicinal properties, suitable for the rougher parts of the garden. Propagated by divisions.

E. cannabinum (Hemp Agrimony), a tall, downy plant, growing 3 to 6 ft. high, with a reddish stem and large terminal clusters of dull purple flowers. The large leaves are palmately divided into three to five leaflets. It grows best in a wet, calcareous, alluvial soil. Europe, incl. Britain.

E. purpureum (Joe Pye Weed) resembles the preceding but is a better species, growing 8 to 9 ft. high, with reddish-purple flowers. North America.

FILIPENDULA (Rosaceae) 10 sp. Name from the Latin *filum*, thread, and *pendulus*, hanging, from the numerous small tubers of *F. hexapetala* hanging together by thread-like roots. Meadow Sweet. Beautiful hardy perennials, formerly associated with the Spiraeas, but now held distinct because of the herbaceous habit, pinnate leaves and differences in the fruit. Most of them delight in moist, rich soil in a sunny or semi-shaded situation. The Meadow Sweets are particularly decorative grown by the poolside or river bank; in positions where the heavy plumes of flowers may be advantageously reflected in the water. They are propagated by seed, sown in a cool house in spring, or by division.

F. camtschatica (*Spiraea camtschatica*). A native of Kamchatka and Manchuria, this fine species may be described as a gigantic Meadow Sweet: with dark green leaves and loose panicles of white flowers. Height 6 to 10 ft.

F. hexapetala (*Spiraea Filipendula*; *Ulmaria Filipendula*) (Dropwort). A British species, growing 1 to 3 ft. high, with stout, leafy stems and crowded, upright heads of creamy flowers. Siberia; Western Asia; Europe.

F. hexapetala var. *plena*, the double form, is more decorative than the type and has distinctive fern-like foliage. Height 18 in.

F. purpurea (*Spiraea palmata*) is undoubtedly the most beautiful member of the genus and one of the finest hardy plants for the water garden. It has handsome, palmate, dark green foliage and heavy cymes of carmine or deep rose flowers in late summer. Height 2 to 4 ft. Japan.

F. purpurea var. *alba*. A pretty form with white blossoms.

F. rubra (*Spiraea lobata*; *Ulmaria rubra*) (Queen of the Prairie). A beautiful species, growing 2 to 5 ft. tall, with large pinnately-divided leaves and broad clusters of fragrant, rosy-carmine flowers. North America.

F. rubra var. *venusta* has deep pink or carmine flowers.

F. rubra var. *venusta magnifica*. A fine variety, growing 5 to 6 ft. high, with heavy plumes of rose-crimson blossoms in late summer.

F. Ulmaria (Spiraea Ulmaria). Our British Queen of the Meadows is rarely cultivated although it makes a handsome wild garden subject. Growing 3 to 5 ft. high, it likes a very moist position and has showy blooms of creamy flowers borne on leafy stems. Europe, incl. Britain, and Western Asia.

F. Ulmaria var. *aureo-variegata* makes a decorative water-side subject, having the foliage variegated with creamy-yellow.

F. Ulmaria var. *plena*. A double-flowered form of the type.

FUNKIA. See HOSTA.

GENTIANA (Gentianaceae) 400 sp. Named after King Gentius of Illyria, who first discovered their medicinal properties. Gentians are among the most desirable of all hardy plants, and a few are adapted for moist spots in the bog garden. They should be given a deep, rich soil and are propagated by seed or offsets.

G. Andrewsii (Bottle or Blind Gentian). A stout North American perennial, growing 1 to 2 ft. tall, with simple, leafy stems and axillary clusters of rich blue flowers. It dislikes limey soil and prefers a sandy compost, doing very well at the pond margin.

G. Andrewsii var. *alba* is a very rare white-flowered form.

G. asclepiadea (Willow Gentian) likes to grow in a partially shaded position, and has graceful bending stems with narrow lanceolate leaves and axillary clusters of rich blue flowers in autumn. Europe.

G. asclepiadea var. *alba* is a good form with white flowers.

G. flavida (*G. alba*), an erect perennial with stout, clasping leaves and several large, dull yellowish-white flowers borne in a terminal head. North America.

G. Pneumonanthe (Marsh Gentian). A charming native species growing 6 to 12 in. high, the slender stems bearing several bell-shaped, rich blue flowers which are lined with five green stripes.

G. Saponaria (Soapwort Gentian) grows 1 to 2 ft. high with crowded spikes of light blue club-shaped flowers. North America.

G. serrata (*G. detonsa*) (Fringed Gentian). A pretty little annual growing 6 to 18 in. tall, the bright blue flowers fringed at the petal edges. It is suitable for growing in wet, marshy places. North America.

GEUM (Rosaceae) 40 sp. Name used by Pliny for a plant with



IRIS KAEMPHERI



IRIS SIBIRICA PERRY'S BLUE



MIMULUS LEWISII ALBA

A good plant for a moist but well-drained situation



TROLLIUS ARE DAINTY SUBJECTS FOR WATERSIDE PLANTINGS



LYSICHITUM CAMTSCHATCENSE



STATELY LILIES THRIVE IN SHADY, DAMP, BUT WELL-
DRAINED POSITIONS.



TRILLIUM GRANDIFLORUM, THE WAKE ROBIN

thin, black, aromatic roots, curative of pains in the back and elsewhere.

G. rivale (Water Avens), a weedy native plant sometimes grown in marshy places; attaining a height of 10 or 12 in. with dull purplish-pink flowers and strawberry-like leaves. There is also a white form, var. *album*.

GILLENIA (Porteranthus) (Rosaceae) 2 sp. Named for an obscure German botanist of the seventeenth century—A. Gille or Gillenius.

G. trifoliata (Bowman's Root; Indian Physic). A distinct and graceful plant growing freely in a peaty, loamy soil and favouring semi-boggy positions. The stems attain a height of 2 ft., branching above into loose sprays of pretty white flowers with green spiraea-like foliage. Propagated by seed or division. North America.

G. stipulata (America Ipecacuanha) resembles the following species but is taller and more hairy. North America.

GLADIOLUS (Iridaceae) 200 sp. Latin name *Gladiolus*, meaning a little sword and referring to the sword-like leaves.

G. palustris. A South and Central European species, growing 1 to 2 ft. high, with a coarsely-netted tunic around its corm, erect leaves and a loose, three to six-flowered, one-sided inflorescence of medium-sized, purple-red flowers.

GUNNERA (Haloragidaceae) 40 sp. Named after J. Ernst Gunner, 1718-1773, a Swedish Bishop and botanist.

Handsome foliage plants that create an inimitable air of grandeur at the waterside. The leaves are the largest known to cultivation, resembling gigantic rhubarb, whilst the inflorescence is just as remarkable, consisting of small flowers sitting on conical, fleshy masses a few inches long; these in their turn being seated on a thickly-packed stem several feet high. The whole resembles a gigantic forked cone or pipe cleaner, and is a most extraordinary sight. 'If anybody wants to see what Nature can do in the way of a season's growth,' writes Maurice Hewlett, 'I can tell him how to go to work. Let him plant on the bank of a running water a root of *Gunnera manicata*. Let him then wait ten years, observing these directions faithfully. Every fall, after the first frost—the frost that blackens his dahlias—let him cover the crown of his *Gunnera* with one of its own leaves. Pile some stable-stuff over that, and then heap upon all the leaf-sweepings of that part of the garden. Growth starts in mid-April and proceeds by a foot a week. Mine,

which is about ten years old now, is thirty-five feet in circumference, nearly twelve feet high, has flowers two feet six in length, and in a hot summer has grown leaves seven feet across. You can go under one of them in a shower of rain and be as dry as in church. And all that is done in five months.' One of the finest specimens in the British Isles is that in Mr. Bowles' garden at Enfield, where the largest leaves are 9 ft. across and 7 or 8 ft. high. This specimen is round about thirty years old and planted in an open position in moist, sloping ground. In the autumn, when frost cuts the leaves Mr. Bowles has them inverted over the crown of the plant, where they form a mulch and protection. In summer storms it is possible for several adults to shelter in perfect dryness beneath the leaves of this splendid specimen. Propagation by division.

G. magellanica, a charming but small species, with dark green, orbicular, reniform leaves about $2\frac{1}{2}$ in. across. Suitable for a damp spot in the rock garden. Chile.

G. manicata (*G. brasiliensis*) is the finest species; the gigantic leaves from 5 to 10 ft. across on long, prickly petioles. They are orbicular, lobed and crenate; the flowers borne on dense spikes 3 to 4 ft. tall and more than 1 ft. in diameter, being of a rich green shade. The crown of this plant sometimes measures 20 to 25 ft. across—making a magnificent waterside subject. The roots must never suffer from lack of moisture; a rich soil with some sunshine is advisable, and in winter the crowns should be protected with leaves or litter.

This species was introduced into Europe between 1859 and 1861, by Joseph Libon, a Belgian collector, who travelled for Jean Linden in Brazil. It grows wild on the Serra de Mar of Santa Catharina, a mild, temperate region with an annual rainfall rather like that of Western Great Britain.

G. Chilensis (*G. scabra*) is smaller than preceding, but yet an enormous plant. The leaves attain a height of 3 to 6 ft. and are 4 to 5 ft. across; the flowers being more reddish and not so tall. This plant will grow in a drier situation than *G. manicata*, but should be protected in winter in the same way. Chile.

G. scabra var. *minor*, a pigmy form for the small water garden, growing 15 to 18 in. high.

HACQUETIA (*Umbelliferae*) 1 sp. Named after Balthasar Hacquet, 1739-1815, a writer on alpine plants.

H. Epipactis (Dondia Epipactis). A pretty little spring-flowering plant requiring moist, peaty soil; the slender stems carry umbels of greenish-yellow flowers. Radical, palmate, deeply-lobed leaves of a rich green colour grow 3 to 8 in. high and are generally taller than the inflorescence. Propagated by divisions in the early spring. Central Europe.

HELONIAS (Liliaceae) 1 sp. From *helos*, a marsh, referring to the habitat. Swamp-pink; Stud flower.

H. bullata, a handsome bog perennial producing close rosettes of shiny, dark green foliage, from which arise hollow stems bearing dense spikes of purplish-pink flowers. Height 1 to 2 ft. Propagated from the offsets. North America.

HELONIOPSIS (Liliaceae) 4 sp. Name from *helos*, a marsh. Herbaceous perennials very similar to Helonias but with larger and fewer flowers. Propagation similar to that genus.

H. breviscapa (*H. grandiflora*) requires a sunny or partially shaded, moist position, and has radical spoon-shaped leaves and slender spikes of drooping blush-white flowers with purple stamens. Height 1 ft. Japan.

H. japonica is similar to the preceding, but with deep pink flowers; the leaves are tinged with brown and purple. Japan.

HEMEROCALLIS (Liliaceae) 5 sp. Old Greek name meaning 'beautiful for a day', because the individual flowers are short-lived. Day Lily.

An invaluable genus for bog and water garden settings; producing a richness of colour and wealth of flower unrivalled by any other class of plant. Neither fastidious nor difficult of cultivation: their compact, sturdy habit of growth is fatal to weeds, which are smothered under the arching mats of foliage. Once established, the clumps can be left undisturbed for an indefinite period without detriment to the quantity or quality of flowers produced; the foliage is attractive even when the plant is out of flower, no other subject providing quite that same effect of tender green. Plant them freely, close to the water's edge, that the roots may penetrate to the rich lushness beneath; and pay some attention to the plants around, ensuring that these too are of beautiful habit. Osmundas, Hostas, Adiantum pedatum and Astilbes suggest themselves as suitable companions and should be freely represented at the pond margin. Besides the various species, some of which should be cultivated, there are to-day countless

horticultural varieties, many of outstanding merit. To the late Mr. George Yeld of Gerrards Cross we owe the first introductions; he was the pioneer in experimenting with the Day Lily and to him we are indebted for many beautiful varieties. British and American hybridists have also been busy with the genus, including my father-in-law, Mr. Amos Perry, who has at last achieved his ambition of producing a white form. From their productions the gardener should be able to choose a varied selection, both as to colour and season of flowering.

Hemerocallis have some economic qualities, for in the Orient the flower petals are gathered, dried and made up into packets under the name of gum stay (Golden Vegetables) or gum jum (Golden needles). The Chinese esteem these a great delicacy, soaking the petals out in water when they become gelatinous, and are used in soups, or for garnishing meat dishes in the same way as we do mushrooms or tomatoes. Propagation by division.

It is impossible to describe fully all the known sorts; we therefore append a selection of the finest species and varieties.

H. Apricot was Mr. Yeld's first variety and is still one of the best. A dwarf, it grows $2\frac{1}{2}$ ft. high with medium-sized apricot-coloured blooms in July.

H. aurantiaca major. A variety of exceptional merit with large, open flowers, a uniform shade of rich orange. Height 2 ft. July flowering. Japan.

H. E. A. Bowles. A fine variety, growing $3\frac{1}{2}$ ft. high, with very large, well-expanded flowers which are often 6 in. across and of a delightful shade of orange-apricot with a faint reddish zone. Flowering July and August.

H. flava (Lemon Lily). A pretty June-flowering species with graceful arching leaves and rich, clear yellow, sweetly-scented flowers. Height $2\frac{1}{2}$ ft. Temperate Europe; Asia.

H. Forrestii. A Chinese introduction, producing neat tufts of grassy foliage: the arching stems carry a profusion of medium-sized brilliant orange blooms. Height 18 in. Flowering July to August.

H. fulva (*H. disticha*) is a species with a flower stem forked near the summit and carrying several brownish-orange flowers. Europe; temperate Asia.

H. fulva var. *Kwanso* has double flowers; it has a sub-variety with striated or variegated leaves.

H. fulva var. *rosea* adds a rare touch of colour to the waterside, for the blooms are a delightful shade of soft glowing rose. It grows $2\frac{1}{2}$ ft. tall and is very free; the graceful grassy foliage also being most attractive. This wild variety is the parent of many of our best new forms. Japan.

H. George Yeld has fine, open, trumpet-shaped flowers—nearly 6 in. across—the petals rich orange, flushed and mottled with orange-scarlet. It is in flower from July to August.

H. Imperator carries large, open, star-shaped flowers up to 5 or 6 in. across, a delightful shade of rich orange-red with a conspicuous base. Height $3\frac{1}{2}$ ft. Flowering July.

H. Hyperion. A very fine new variety with exceptionally large, open flowers of a rich golden-yellow shade. Growing $2\frac{1}{2}$ ft. high, it flowers in July and August.

H. J. S. Gaynor, one of Mr. Yeld's last introductions, producing large, well-expanded flowers, a delightful shade of rich butter-yellow. It is the finest form we have in this shading and grows about 3 ft. tall, flowering in July.

H. June Boissier. A particularly fine variety, the stout, branching stems towering well above the broad foliage. The flowers are well expanded—over 6 in. across when well established—and a brilliant shade of rich orange-bronze, with a pale crimson zone and a sulphur-yellow base. Height $3\frac{1}{2}$ ft. Flowering July and August.

H. Marcus, with narrow, recurving foliage, grows about $2\frac{1}{2}$ ft. high, carrying large, open, amaryllis-like flowers—of a rich orange-yellow shade, suffused with bronze.

H. Margaret Perry is a beautiful variety, growing $3\frac{1}{2}$ ft. high, making a clump 4 to 5 ft. across if left undisturbed. The abundant, recurved, grassy foliage is attractive all the summer, whilst branching stems support many large orange-scarlet flowers. An added charm is the conspicuous yellow line which runs down the centre of each petal. This variety is one of the most useful owing to its extended flowering period, which runs from July to September.

H. May Sadler grows about 2 ft. high and bears many medium-sized, brilliant reddish-brown flowers having an orange-yellow throat. July.

H. Mikado. A handsome American form raised by Dr. Stout, flowering in July and August and attaining a height of $2\frac{1}{2}$ ft. The

large, open flowers are of a rich yellow shade with a conspicuous orange-scarlet zone.

H. Viscountess Byng is one of the most distinct of the many new varieties of recent introduction, the blooms being of a delicate silver-grey colour overlaid with orange-rose and with an orange-yellow base. Height 2 ft.

H. Wau-Bun is another of Dr. Stout's forms and has evergreen foliage. The flowers are of an amaryllis-shape, the overlapping segments slightly twisted towards the tips, and of a light cadmium-yellow overlaid with fulvous red.

HERACLEUM (Umbelliferae) 70 sp. Dedicated to Hercules, who, according to Pliny, used it in medicine. Cow Parsnip.

H. giganteum (*H. villosum*). A bold subject for the waterside, growing 8 to 12 ft. high, with enormous 'plate-like' heads of white flowers and large, lobed leaves. Toy pop-guns are sometimes fashioned from the hollow stems. Propagated by seed. Caucasus.

HIBISCUS (Malvaceae) 160 sp. Old Latin name, Rose Mallow.

H. incanus, often confused with *H. Moscheutos* which it much resembles. Flowers sulphur, pink or white with a crimson eye, and somewhat hairy. North American swamps.

H. Moscheutos (*H. palustris*) (Swamp Rose Mallow). A robust perennial, growing 3 to 6 ft. high, with strong and effective foliage and showy light rose flowers, often 4 to 6 in. across. When well established, a clump of Hibiscus makes a most imposing picture, but unfortunately, although reputed to be of easy culture—as perhaps they may be in the U.S.A.—yet here they often prove difficult to rear. Propagation by seed.

H. Moscheutos var. *albus* is similar to preceding except in the colour of the flower, which is white with a purple eye.

H. oculiroseus has white flowers with a dark crimson centre. North American marshes.

HOSTA (Funkia, Niobe) (Liliaceae). About 30 sp., native to Eastern Asia. *Hosta* commemorates two Austrian botanists, Joseph Host and Nicolous Thomas Host (1761-1834), author of a flora of Austria and finely illustrated folio works on *Gramineae* and *Salix*. Plantain Lily.

The group is invaluable for woodland or waterside planting; the bold, prominently-veined foliage renders the plants attractive even when out of flower. They should be left alone to grow into big clumps, and should be planted in deep, rich soil; they thrive in

both sun and shade. Propagate by division. The genus is much confused as to names in gardens.

H. bella makes robust clumps of dark green, cordate basal leaves, about 5 in. broad, like those of *H. ventricosa*, but the flowers are narrowly funnel-shaped and paler in colour. Height 2 to 3 ft. Japan?

H. decorata (sometimes called *Funkia* 'Thomas Hogg') is a low-growing species, with dull, dark green leaves (entirely green in var. *normalis*, but white-margined in the type var. *marginata*), comparatively blunt and flat and about 4 in. broad. The flower stem is more or less leafless, rises to as much as 2 ft. and has broad dark lilac flowers. Japan.

H. erromena (*H. undulata* var. *erromena*). A robust plant widespread in gardens, forming large clumps of dark green (not glaucous) leaves, with elliptic or broadly-ovate leaves much overtopped by the 2 to 3 ft. high flower stem which commonly carries two or three-petioled leaves in the lower part and ends in a loose raceme of pale lilac funnel-shaped flowers. This may be the normal form of *H. undulata*. Japan.

H. Fortunei (*H. glauca* var. *Fortunei*) has cordate glaucous leaves, up to 8 in. long by $6\frac{1}{2}$ in. broad, smaller than those of *H. glauca*, and racemes of pale lilac blooms on 2 ft. stems which considerably overtop the leaves. Japan.

H. glauca (*H. Sieboldiana* of various authors; *Funkia Sieboldi*) is perhaps the most ornamental member of the genus, with big cordate leaves (14 in. long by 10 in. broad) very glaucous above and below. The pale lilac funnel-shaped flowers are densely clustered on stems which hardly rise above the leaves. Japan.

H. lancifolia (*H. japonica*; *Funkia lancifolia*) is a smaller-growing species with long-stalked lanceolate leaves (usually less than 2 in. broad) and loose racemes of pale lilac flowers from August to September. Japan.

H. rectifolia (*Funkia longipes* of gardens; *Funkia ovata* var. *intermedia*) has rather erect, green (not glaucous) leaves, the blade lanceolate and up to 3 in. broad. The flower stem rises about 2 ft. and carries widely-opened dark lilac flowers. Japan.

H. undulata (*Funkia lancifolia* var. *undulata*) has curiously twisted, pointed leaves (up to $3\frac{1}{2}$ in. broad) with bold, length-wise, white variegations. The flower stem bears several leaves and the lilac flowers are narrowly funnel-shaped. Japan.

H. ventricosa (*H. coerulea*; *Funkia ovata*) makes large clumps of broad, ovate, dark green leaves, overtopped in July by tall stems—up to 3 ft. high—carrying large, purple-blue, abruptly swollen flowers. China.

INULA (*Compositae*) 100 sp. Ancient name, derivation uncertain.

Showy perennial composites, one of which is suitable for the water garden. Propagated by division or seed.

I. Helenium (*Elecampane*; Horseheel) favours a wet, sunny position and grows 3 to 5 ft. high with very large, wrinkled, oblong leaves, downy beneath. The flowers, borne in terminal heads, are of a bright yellow colour and about 3 in. across. The thick carrot-like roots contain a volatile oil, an acid resin, a bitter extract, and a white starchy powder named Inuline. It also furnishes the French Vin d'Aulnée used in diseases of the chest and lungs. Europe, incl. Britain.

IRIS (*Iridaceae*) 200 sp. Name from the Greek meaning rainbow.

The genus gives us certain of our most effective plants for naturalising by the waterside; and by careful selection and by planting some in sun, some in shade, the flowering period may be lengthened so considerably that there will be Irises in flower almost all the summer. Generally speaking, the waterside kinds like a moist, lime-free soil and flourish best in a rich vegetable compost. They are propagated by seed (a slow method) or division of the roots.

From the swamps of South-East U.S.A., a large number of very beautiful irises, too many to mention here, have been described by J. K. Small and Alexander as species: it now seems probable that most of these have arisen from the meeting and hybridisation of a few species, notably *I. fulva* and *I. gigantea-coerulea*—consequent on the creation by ditching, deforestation and cattle-grazing of new habitats.

I. aurea. A robust plant which under favourable conditions will attain 4 or 5 ft. in height, producing broad, sword-shaped foliage and several large, rich golden flowers. Himalayas.

I. Bulleyana. A beautiful Chinese species for waterside planting, growing 18 to 30 in. high, with grassy leaves and rich blue flowers.

I. caroliniana is very like *I. versicolor*, with lilac flowers variegated in purple, brown and yellow. It is native to the swamps of North America.

I. chrysographes likes a moist, sunny position; the flowers are bright purple veined with golden yellow, the foliage neat and grass-like. Height 2 ft. China.

I. chrysowegi. A hybrid from *chrysographes* and *Hartwegii*, raised several years ago at Enfield. The flowers, appearing in June and July, are large for the type; of a royal purple-blue colour with a conspicuous gold line running through the falls. Height 18 in.

I. cristata. A dwarf plant of creeping rhizomatous habit, with thin grassy leaves 4 to 6 in. long. The rich lilac flowers are small and shaded white with a prominent golden blotch on the petals. North America.

I. cristata var. *alba* has white flowers in May.

I. Delavayi, a native of the Yunnan marshes in China, will attain under favourable moist conditions a height of 5 ft. The flowers are 2 to 2½ in. across, of a brilliant violet shade spotted with white.

I. Forrestii is related to *I. sibirica* and was found in Western China just before the Great War. It has soft yellow blooms and grassy foliage and grows 18 to 24 in. high.

I. fulva (cuprea). A shy-flowering species but worth introducing to the bog garden on account of its unusual colouring; the flowers being of a bright coppery-brown, veined in purple. The petals spread horizontally—as in the *Kaempferis*—and the leaves are bright green and thin. Native to Texan swamps.

I. hexagona is very similar to *I. versicolor* but the flowers are larger.

I. Kaempferi. The Clematis-flowered Irises of Japan are by far the most picturesque group for the water garden; the colours varying through shades of white, blue, red, violet, crimson and yellow—often with bold and elaborate markings. The petals being held in a horizontal position resemble gaily-patterned sunshades when seen from a little distance and give an unequalled display of brightness and beauty. They prefer a sunny position by the waterside, with an abundance of moisture during the growing season, but are calcifuges so must not be planted in chalky ground. A rich soil is essential; in Japan the plants grow in thick clay which is heavily manured in winter and flooded with water during the spring and summer. By some authorities the *Kaempferis* are grouped with the *laevigatas*, but we have found

the latter to grow actually in water all the year round—a situation which would be fatal to the *Kaempferis*. The species are also distinguished by a prominent ridge which runs along the midrib of the leaves of *I. Kaempferi*—absent in *laevigata*. There are very many beautiful varieties of the Clematis Iris, many hailing from Japan and sent out under Japanese names. The following selection includes the best-known and some of the most handsome forms.

Blue Peter, rich china blue, with an Oxford blue centre.

Brocade, violet-purple, double blooms with yellow markings at the base of each petal.

Crown Princess, bright, semi-double, lavender-blue flowers with a conspicuous yellow central blotch.

Dancing Girl, double white, faintly washed with blue.

Dawn of Spring, double wine-red.

Landscape at Dawn, duplex blooms 8 in. across, of a rich lavender shade spotted with yellow.

Morning Mist, single snow-white flowers with a yellow-lined base.

Mikado, rosy-crimson lined with white.

Moonlight Waves, semi-double snow-white flowers.

Water Nymph, large, snow-white, semi-double flowers with a bright yellow base.

White Pearl, broad, rounded petals of a snow-white colour with a yellow base.

I. lacustris (Lake Iris). A dainty little Iris, growing 6 to 12 in. high, with sky-blue flowers which appear in spring and again in autumn. It is found on the shores of Lakes Huron and Superior in North America.

I. laevigata. A beautiful plant that thrives equally well in very wet soil as in 3 or 4 in. of water at the pond margin. Growing about 2 ft. high, the erect stems bear rich blue flowers with a golden spot on the claw. The foliage is thin and grassy. East Siberia; Japan.

I. laevigata var. *alba*. The white counterpart of preceding; the two look very well when grown together.

I. laevigata var. *atropurpurea* has rich violet blooms.

I. laevigata var. *Rose Queen*. The flowers of this variety are not so large, and of a delightful soft rose shade. Height 2 ft.

I. laevigata var. *variegata* has pale blue flowers and white striated foliage.

I. monaurea. An attractive hybrid from *Monnieri* and *aurea*, with broad sword-like foliage and rich golden flowers. Height 4 to 5 ft.

I. Monnieri must be grown in masses to produce any effect. It has branched stems carrying lemon-yellow flowers and sword-like foliage. Height $2\frac{1}{2}$ to $3\frac{1}{2}$ ft. Origin doubtful; sometimes attributed to Greece.

I. orientalis (*I. sanguinea*; *I. extremo-orientalis*). A very beautiful Iris, often regarded as a variety of *sibirica*, but with stems about equal to the leaves in length. It has brilliant violet flowers with conspicuous crimson spathes, the latter rendering the bud a pleasing sight even before it opens. The leaves, also, are often tinged with reddish-purple at the base. Height $2\frac{1}{2}$ ft. Eastern Asia.

I. Pseudacorus is the original of the famous French royal emblem, the *Fleur-de-lis* or *Flower-de-luce*, and will grow in shallow water or at the pond edge; being especially adapted for wild garden settings. It grows to a height of 2 to 3 ft., forming fine large clumps, the flowers being bright yellow and the leaves broad and sword-like. On account of the acrid nature of the root the plant formerly enjoyed some medicinal reputation as a remedy for coughs, toothache and dyspepsia: whilst the roasted seeds, carefully prepared, are supposed to make a good substitute for coffee. Europe, incl. Britain; N. Africa; Asia Minor.

I. Pseudacorus var. *alba* is an almost white-flowered form.

I. Pseudacorus var. *Bastardii* bears lighter coloured flowers than the type, these being of a soft primrose-yellow.

I. Pseudacorus var. *variegata* is perhaps the most decorative variety with golden flowers and creamy-yellow leaf variegations.

I. sibirica. A beautiful group of summer-flowering Irises which make good cut flowers and are indispensable for the water garden. The roots form a dense spreading mat, the leaves are green, arching and tufted, and the flowers stand erect on forked stems much overtopping the leaves. They thrive best in a rich vegetable soil abundantly supplied with moisture. The typical plant, a native of Europe, not Siberia, has small lilac-blue flowers, but the hybrids are more generally grown. The following is a representative list of the finest varieties now in cultivation.

I. sibirica var. *Caesar*. A fine erect plant with large brilliant violet-purple flowers. Height 3 ft.

I. sibirica var. *China Blue*. A delightful form raised at the botanic gardens in Ottawa, with branching stems some 3 ft. high carrying pale blue flowers.

I. sibirica var. *Emperor*. A fine hybrid of recent introduction which will attain 4 ft. in height with large violet-blue flowers.

I. sibirica var. *Ottawa* has purple flowers edged with white.

I. sibirica var. *Perry's Blue*. An old favourite but still one of the best; growing 4 ft. high with large flowers, 4 to 5 in. across, in two shades of blue—the falls soft china-blue and the standards sky.

I. sibirica var. *Snow Queen*. A pretty form, growing about 2 ft. high, with pure white flowers.

I. spuria. A stiff little plant not as pleasing as many of the waterside species. It grows 3 ft. high, with silvery-blue flowers and firm linear leaves. Central and S. Europe.

I. spuria var. *alba* has white flowers.

I. versicolor, when planted near the water edge, makes good cover for wild fowl as it spreads rapidly in moist soil. It is almost a purple counterpart of *I. Pseudacorus* and grows about 2 ft. high, with violet-blue flowers variegated with yellow, green and white. The rhizome is very acrid and possesses some medicinal properties.

I. versicolor var. *arkansensis* is the better plant, with light blue flowers spotted with purple. Height 2½ ft.

I. versicolor var. *kermesina* has flowers of a rich claret colour with bold white markings. Height 2½ ft.

I. virginica. Very close to *I. versicolor*, but differing in many slight characters. Flowers blue or violet-blue.

ITEA (Saxifragaceae) 6 sp. Greek name of the willow; perhaps because it grows near water.

I. virginica (Virginian Willow). A dwarf, deciduous North American shrub suitable for a damp spot near the water edge. It grows 2 to 4 ft. high with smooth, green, willow-like leaves (which in autumn become brilliantly coloured) and erect spikes of fragrant, small, white flowers. Propagated by divisions or cuttings.

JEFFERSONIA (Berberidaceae) 2 sp. Named in honour of Thomas Jefferson (1743-1826), third President of U.S.A.

J. diphylla (Twin-Leaf; Rheumatism-Root). An interesting Eastern North American perennial with a rhizomatous root and

radical leaves deeply lobed into two sections. The flowers are white, single, and about 1 in. across. The plant is suitable for damp, shady spots and is propagated by division or seed sown directly after gathering. Height 6 to 8 in.

KIRENGESHOMA (Saxifragaceae) 1 or 2 sp. Name from the Japanese, *Ki*, meaning yellow, and *Renge-shoma*, Japanese name for *Anemonopsis macrophylla*.

K. palmata. A strange and beautiful yellow-flowered perennial from Japan, suitable for a partial shady position near the waterside, and propagated by division. Growing 2 to 4 ft. high, it is of spreading, bushy habit, with dark purple stems, large, papery, jagged leaves which are hairy on both sides, and loose sprays of bell-shaped yellow flowers in autumn. A not very distinct variant *K. Koreana* occurs in Korea.

LATHYRUS (Leguminosae) 110 sp. Name *Lathyras* used by Theophrastus.

L. palustris (Marsh Pea). A good bog plant of perennial habit, growing 1 to 3 ft. in length, with narrow leaves in pairs and abundant purple, pea-like flowers (about $\frac{1}{2}$ in. long). Arctic and North America; also in Europe (rarely in Britain) and Asia.

L. palustris var. *myrtifolius* (Myrtle-leaved Marsh Pea) has broader leaves, attractive tendrils and pale purple flowers. Native to river banks in North America.

LEUCOJUM (Amaryllidaceae) 10 sp. The name *Leukuion* (*leukos*, white; *Ion*, a violet) was applied by the ancient Greeks and subsequent writers to a wallflower or stock, and transferred later to the present genus. Snowflake.

Hardy, bulbous plants growing from 6 in. to 2 ft. high, and most effective when planted in dense clumps. They should be placed about 3 in. deep and, once established, left undisturbed. The white Snowdrop-like flowers appear in spring and early summer.

L. aestivum (Summer Snowflake) grows 12 to 24 in. high, with long, yellowish-green, strap-shaped leaves and clusters of three to seven pure white pendulous flowers, each petal tipped with green. This species will thrive in wetter spots than almost any other bulbous plant. Central and Southern Europe.

L. pulchellum (*L. Hernandezii*; *L. aestivum* var. *Hernandezii*) is very like the preceding, but flowers about a fortnight earlier. Balearic Isles; Corsica; Sardinia; Italy; S. France.

L. vernal (Spring Snowflake; St. Agnes' Flower). A beautiful little spring-flowering species, the drooping blossoms appearing about a month after the Snowdrop. They are white tipped with green, solitary, and delightfully scented. The strap-shaped leaves grow 6 to 9 in. high. Central Europe.

LIGULARIA. See SENEIO.

LILIUM (Liliaceae) 60 sp. Ancient Latin name from the Greek *Leirion*. Lily.

A few members of this beautiful genus will flourish in or near the bog garden, and certainly the family should be represented as for stateliness and grace of habit it stands alone. The North American species are especially easy to cultivate in such situations and should be accorded shady, damp, but well-drained positions. Propagated by division of the offsets or by seed.

L. canadense (Canadian Lily) is one of the oldest of cultivated lilies and grows well in moist, peaty soil enriched by decayed leafmould. The bulb is rhizomatous, the stem growing 3 to 5 ft. high with whorls of lanceolate leaves, and bright orange-yellow flowers with recurved petals which are freely spotted with brown below. The anthers are red. It favours a half-shady position.

L. canadense var. *rubrum*. The bell-shaped flowers of this pretty variety are a striking shade of deep orange-red.

L. michiganense. An Eastern North American lily near to *L. canadense*, with whorled leaves and orange-red, copiously brown- or crimson-spotted flowers, the segments recurved as in *L. canadense*.

L. pardalinum (Panther Lily). A stately Californian species, producing stout stems carrying up to thirty recurved flowers. These are of a drooping habit and are bright orange-scarlet, freely spotted with maroon. This is one of the hardiest and most satisfactory lilies to grow; in rich, moist soil in a sheltered position it is quite permanent and increases rapidly.

L. superbum (Swamp Lily). One of the handsomest of North American lilies and eminently suited to English gardens. Growing 3 to 8 ft. high, the purplish stems carry flowers, 3 or 4 in. across, of a brilliant orange-scarlet colour, freely spotted with maroon.

LOBELIA (Campanulaceae) 220 sp. After Matthias de L'Obel (1538-1616), or Lobelius, a Flemish botanist and author. See also pages 108 and 158.

The perennial species of this genus make handsome waterside

plants, especially when planted in masses for group effects. Although fond of abundant moisture during the growing season, the roots should not be too wet during the winter; the majority are therefore best lifted in the autumn and stored away in cold frames until the following spring. Propagated by division in early spring.

L. cardinalis (Cardinal Flower) should be planted close to the water that the reflection of its glorious colour—so rare in hardy plants—may be mirrored in the depths below. In a rich, moist soil and a 'colander' light it attains a height of 2 to 4 ft., with oval, lanceolate leaves and most intensely vivid scarlet, *Salvia*-like flowers. North America.

L. fulgens is not as hardy as *L. cardinalis*, but somewhat similar, with larger, deeper and more showy flowers. Mexico.

This species has given rise to many beautiful horticultural varieties, including the following:

Gerardii, has violet flowers, in character for a lengthy period.

Gerardii coralline, coral-red, in flower all the season.

Gerardii Ibis, scarlet.

Gerardii malmaison, fiery red with reddish foliage.

Gerardii Rivoirei, has green foliage and delicate rose-pink flowers with ruby markings.

Huntsman, glowing scarlet.

Lord Ardilaun, vermilion-scarlet.

Purple Emperor, bright green foliage, rich purple flowers.

Queen Victoria, an old favourite with attractive crimson foliage and dazzling scarlet flowers.

Rose Gem, bright rose.

L. Kalmii (Brook Lobelia), a useful bog plant, growing 6 to 18 in. high, with branching sprays of bright blue flowers. North America.

L. sessilifolia. A pretty subject for a shallow water or swampy situation, this rare Manchurian species grows 4 to 5 ft. high carrying tapering spikes bearing small violet-purple flowers.

L. syphilitica (Blue Cardinal Flower). A handsome species with long, hairy leaves and bright blue flowers. It is invaluable for associating with the *fulgens* varieties, and may be left out in winter with perfect safety. Height 18 in. North America.

L. syphilitica var. *alba* grows some 18 in. high and has white blooms.

L. syphilitica var. *nana*. A beautiful little variety, growing only 4 in. tall, with light green crinkled foliage and spikes of pale blue flowers.

LYSIMACHIA (Primulaceae) 120 sp. Derivation doubtful; Linnaeus says after King Lysimachus of Sicily, who first used it in medicine.

Erect or creeping, succulent plants which are very useful in the garden and cultivated by division. See also page 159.

L. clethroides, a stout Japanese species, grows 2 to 3 ft. high, with long, pendant spikes of white blossoms and large, broadly lanceolate leaves (3 to 6 in. long). The blooms make good cut flowers. Japan.

L. Nummularia (Creeping Jenny; Creeping Charlie. Moneywort; Herb-twopence). A well-known plant, useful for its carpeting effects at the waterside; the small, rounded leaves grow in opposite pairs and are $\frac{1}{2}$ to 1 in. long; bright golden cup-shaped flowers appear during the early summer months.

L. Nummularia var. *aurea*, with pretty golden-yellow leaves, is more decorative than the type and may be used for a variety of purposes.

L. thyrsiflora (Tufted Loosestrife). A rare native, much resembling *L. vulgaris*, but bearing golden flowers in dense axillary heads. Height 1 to 3 ft.

L. vulgaris (Great Yellow Loosestrife). A showy plant for the wild garden, growing 2 to 3 ft. high, with tapering leaves and terminal panicles of large yellow flowers. Europe, incl. Britain; Asia.

LYSICHITUM (Araceae) 2 sp. Name in Greek meaning a loose or free cloak; apparently referring to the spathe.

L. americanum (until 1932 always known in gardens as *L. camtschatcense*). The yellow-flowered form, with a most offensive skunk-like smell and enormous deep green leaves which are 1 to 4 ft. long and 3 to 15 in. wide. California to Alaska.

L. camtschatcense (*L. album*; *Lysichiton kamtschatkense*). A handsome Asiatic Aroid having glaucous-green, blunt-tipped foliage which is shorter than in preceding species, and large white Arum-like flowers with an unpleasant odour. The plants should be grown in really wet marsh ground, and make strikingly handsome subjects for the bog garden. Both species have green fruit. Propagated by divisions. E. Siberia; Japan.



PRIMULA JAPONICA



PRIMULA SIKKIMENSIS
Ferns and Typhas at the pool edge



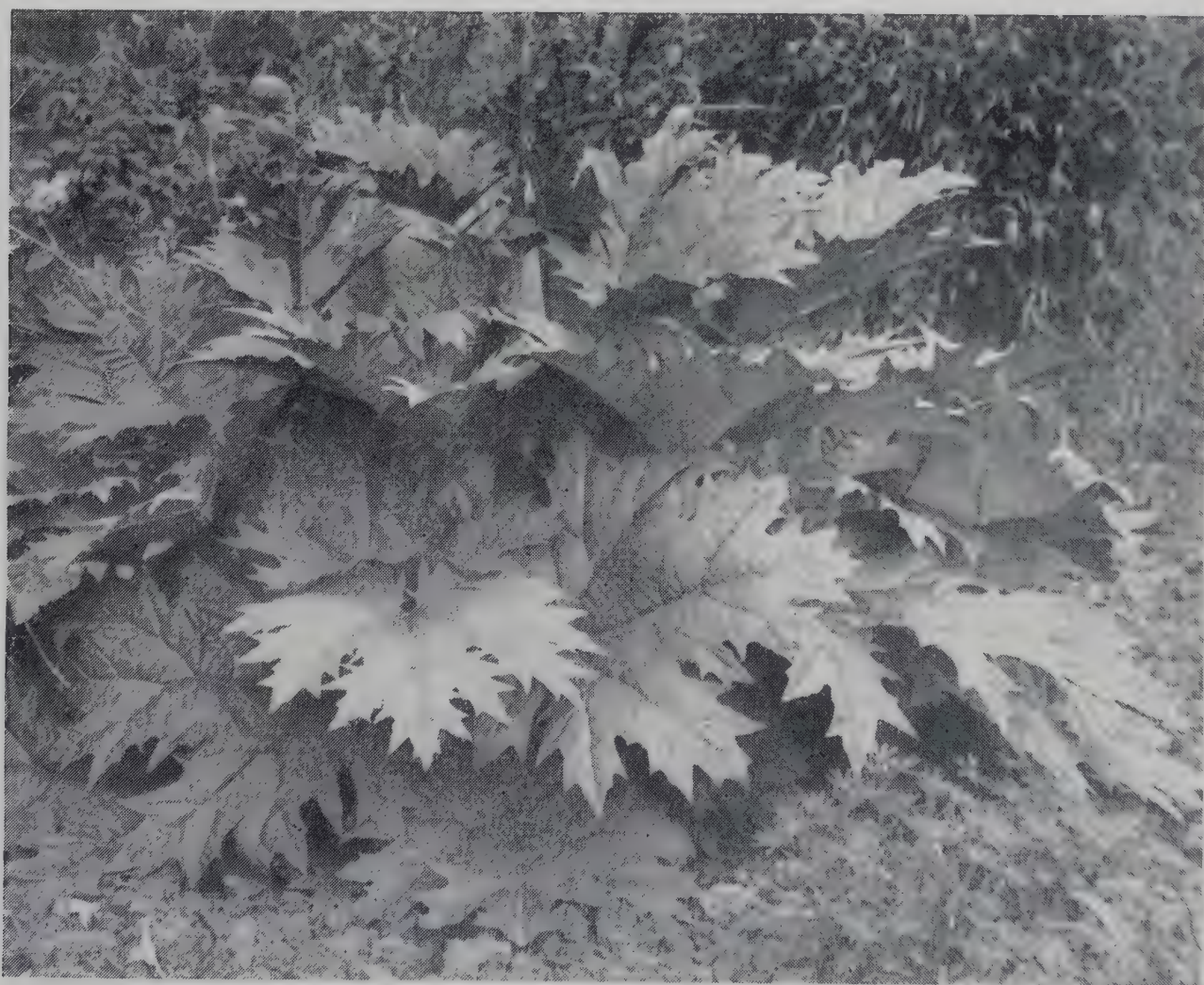
PRIMULA DENTICULATA ALBA



THE BRIGHT FLORETS OF PRIMULA JAPONICA STAND OUT
AGAINST A LEAFY BACKGROUND



SAXIFRAGA PELTATA MAXIMA



RHEUM PALMATUM AND ITS FORMS MAKE HANDSOME
WATERSIDE SUBJECTS



RODGERSIA TABULARIS



RODGERSIA PODOPHYLLA

LYTHRUM (Lythraceae) 24 sp. Name from the Greek *lythron*, blood, from the colour of the flowers.

Natives of low-lying swamp land and ideal for massing in wild garden settings. The plants are perfectly hardy and freely reproduced by divisions.

L. Salicaria (Black Blood; Purple Loosestrife). A showy native plant with reddish-purple blooms, eclipsed in beauty by its hybrids, and so astringent throughout that it has been used in medicine and tanning.

L. Salicaria var. *atropurpureum* bears densely-clothed spikes of rich, dark purple flowers and has tapering, willow-like leaves.

L. Salicaria var. *Brightness* grows about 3 ft. high, with long branched spikes of small, clear pink blossoms.

L. Salicaria var. *Lady Sackville*. A great favourite, growing 3½ ft. tall, with tapering spikes of vivid rose-purple flowers.

L. Salicaria var. *roseum*, *Perry's variety*, has cherry-red flowers, much larger than the type and borne on longer spikes.

L. Salicaria var. *superbum* attains a height of 3 to 5 ft., with narrow, lanceolate leaves and spikes of clear rose flowers. The plant is slightly hairy throughout.

MACLEAYA (Papaveraceae) 2 sp. Named in honour of Alexander Macleay (1767-1848), entomologist; from 1823-1836 Secretary of the Colony of New South Wales.

Imposing hardy plants for the back of the bog garden, where the soil is rich and well drained. Propagation by division.

M. cordata (*Bocconia cordata*) (Plume Poppy) bears large panicles of creamy-white flowers and deeply-lobed, heart-shaped leaves. These have a silver underside—freely revealed when the wind blows. The acrid juice of the plant is said to be used in the West Indies for removing warts. China; Japan.

M. cordata var. *Yedoensis*. An attractive Japanese plant with glaucous-blue foliage, apricot-coloured buds and pure white plumes of flowers. Height 6 ft.

M. microcarpa has golden-brown or bronzy plumes of flowers. Botanical differences distinguish it from *M. cordata*. N. China.

MIMULUS (Scrophulariaceae) 120 sp. From the Greek *mimo*, an ape or actor, because of the grinning appearance of the flower. Monkey Flower.

A showy genus of moisture-loving annuals or perennials, which, planted at the waterside, provide a riot of colour through-

out the whole summer months. Western North America is especially rich in the genus, but Britain has only one representative: the common naturalised Monkey Flower, *M. guttatus*. The many beautiful varieties from this are easily raised from seed, which should be sown in the damp soil at the water edge. During very dry weather it is advisable to protect them with damp moss until germination takes place, thus ensuring constant dampness.

M. alatus is a beautiful North American perennial, something like *M. ringens*, but with petioled leaves; it reaches 1 to 3 ft. high, with deep violet flowers about 1 in. in length, and will grow in shallow water or at the pond margin. Eastern America.

M. cardinalis. A showy plant with hoary foliage and clustered heads of red and yellow flowers. It grows about 18 in. high, with sharply-toothed, oblong, lanceolate leaves. This species will flower the first year from seed. N. America.

M. Lewisii (*M. roseus*). A daintier plant than preceding, with bright green toothed leaves and abundant rosy-crimson blooms. It flowers freely but favours a somewhat shady position. Eastern N. America to British Columbia and California.

M. Lewisii var. *alba* has snow-white flowers. British Columbia.

M. Lewisii, *Perry's variety*. A brightly-coloured form of the type, with orange-scarlet flowers having a yellow and orange throat. Height 15 in.

M. guttatus (*M. Langsdorfi*). A pretty subject for shallow water planting, with ovate sharply-toothed leaves and showy yellow flowers often marked inside with dark spots—the pedicels are less than twice as long as the calyx. Height 18 in. Western North America. Some of the varieties are very fine and are usually grown in preference to the type; whatever the corolla colouring they invariably have yellow throats with purple blotching. These forms include the *tigrinus*, *cupreus* and *maculosus* hybrids and the Hose-in-Hose sorts, which have a double corolla ring. The species is usually known as *M. luteus*; the true *M. luteus* is, however, a Chilean species, mostly glabrous, with pedicels three or more times longer than the calyx and the corolla more open with a narrow tube.

A form of *maculosus* known as Whitcroft Scarlet is an especially handsome carpeting variety, growing only 6 in. high, with an abundance of bright orange-scarlet blossom.

M. radicans forms dense mats of tiny, creeping foliage with small blue and white flowers. Height 1 in. New Zealand.

M. ringens will grow in shallow water and has an erect, square stem, 1 to 2 ft. high, carrying oblong, mostly sessile, serrated leaves and axillary, soft violet-blue flowers. Eastern North America.

MITCHELLA (Rubiaceae) 2 sp. Named after Dr. John Mitchell (d. 1768), one of the first American botanists.

M. repens (Deer Berry). A neat little evergreen of prostrate habit, suitable for damp, shady places. Barton says it is the plant most extensively spread in North America, covering the surface from the 28th to 29th degrees of northern latitude. It has tiny, opposite, rounded leaves, often veined in white, and fragrant little white flowers. These are succeeded by scarlet berries which remain in character all the winter. Propagated by division. North America.

MITELLA (Saxifragaceae) 10 sp. From *mitra*, a cap, in allusion to the shape of the fruit. Mitre-wort; Bishop's Cap. Non-showy plants of slender habit; sometimes planted in shady woodland spots. They like a moist, peaty soil and are propagated by division.

M. diphylla has toothed, somewhat hairy, heart-shaped leaves, and scapes, 10 to 15 in. high, carrying slender racemes of small white-fringed flowers which are well worthy of examination under a lens. North America.

M. nuda will grow in quite boggy soil. It is of stoloniferous habit, with crenate, rounded leaves, and spikes of greenish flowers. Arctic America, in bogs.

MOLOPOSPERMUM (Umbelliferae) 1 sp. Name from Greek, meaning striped seed.

M. cicutarium is a handsome, fern-like perennial growing to a height of 3 to 5 ft. with large, hollow stems. Yellowish-white flowers are produced in umbels, the terminal umbel being very much larger than the others, and the whole inflorescence towering above the feathery, divided lanceolate leaves. The plant grows well in deep, rich soil where there is an abundance of moisture. Propagation by division or by seed sown directly after ripening.

MONARDA (Labiateae) 20 sp. Named after Nicolas Monardez, a Spanish physician and botanist of the sixteenth century.

M. didyma (Bee-Balm; Oswego Tea). Robust plants with brilliant flowers, often grown on the banks of streams and lakes for the colour they impart to the surroundings. In masses they form striking effects and should preferably be planted against a

dark background. The plants grow 2 to 3 ft. high with rough, nettle-like leaves and capitate heads of scarlet *Salvia*-like flowers. The leaves are sometimes used for tea in North America. North America; along stream-banks or in moist soil.

M. didyma var. *alba* is a white-flowered form of the type.

M. didyma var. *rosea* has deep rose-coloured blooms.

MYOSOTIS. See page 113.

NARTHECIUM (Liliaceae) 4 sp. Name from the Greek *narthex*, a rod; significance not evident. Bog Asphodel.

N. ossifragum is often found with its feet in water, amongst the tussocks of grass and sphagnum so characteristic of our native bogs. It grows 6 to 8 in. high with tufts of iris-like foliage, the spikes of rich yellow, star-like flowers standing stiffly erect. Europe, incl. Britain.

NIEREMBERGIA (Solanaceae) 20 sp. Named for Juan Eusebio Nieremberg (1595-1658), a Spanish Jesuit writer on natural history. Cup Flower.

N. rivularis (White Cup) is a very adaptable plant, suitable for a variety of positions. On river banks, in a half-shaded site, it creeps steadily over the ground, clothing it with a uniform carpet of bright green spoon-shaped leaves. Barely pushed above the leafy surface are numbers of creamy-white cup-shaped flowers, each about 2 in. across. It is propagated by divisions or cuttings. Slugs are fond of the blooms. Argentine.

PARNASSIA (Saxifragaceae) 45 sp. Named after Mount Parnassus. Grass of Parnassus.

Moisture-loving subjects of tufted habit and low growth, suitable for shady positions near the water edge and propagated by seeds or division.

P. grandifolia grows 1 to 2 ft. high, the pure white flowers 1 to 2 in. broad, and with large, oval, rich green leaves. North America.

P. palustris. A native species growing about 6 in. tall, with shining heart-shaped foliage and solitary white flowers—the petals conspicuously veined with green lines. Europe, incl. Britain; Asia; North America.

PETASITES (Compositae) 15 sp. Name used by Dioscorides, from the Greek *petasos*, a broad-brimmed hat, referring to the large leaves. Butter-bur.

Rampant plants which must be cautiously introduced to the

garden. The broad foliage creates imposing effects at the waterside and the plant also possesses the merit of flowering early—a reason it is sometimes planted near bee hives. Propagation by division.

P. japonicus has huge leaves $3\frac{1}{2}$ to 4 ft. in diameter. It should be grown close to a stream or lake for finest ornamental effects. The stalks boiled make an excellent vegetable and are also preserved in salt or sugar. The flower buds, which have a slightly bitter flavour, are used abroad as a condiment. Japan.

P. japonicus var. *giganteus* grows as high as a man, the gigantic umbrella-like leaves, with their attractive wavy margins, being most effective. Crowded heads of white composite flowers appear in spring before the foliage.

P. palmatus (*Tussilago palmatus*) (Sweet Coltsfoot) is a smaller plant, inhabiting sphagnum bogs or swamps in Arctic America. Growing 1 to 2 ft. high, it bears rounded, deeply cleft leaves and fragrant white flowers.

PELTIPHYLLUM. See SAXIFRAGA.

PHORMIUM (Liliaceae) 2 sp. From *phormos*, a basket, referring to a use made of the fibre. New Zealand Flax.

A small genus of ornamental foliage plants, with coarse, sword-shaped leaves and rigid spikes of red and yellow flowers. Large specimens have a very fine appearance when placed in prominent positions in the garden; at Glasnevin, a clump of *P. tenax* at the waterside yearly commands admiration. They are not very hardy, so, in exposed positions, should receive light protection during the winter. The genus also makes good subjects for tub planting. *P. tenax* is a most valuable fibre plant, and in New Zealand is put to many uses. It has also been employed medicinally: a decoction of the roasted and macerated roots being applied to abscesses and unbroken chilblains. The Maoris are said to have made love tokens from strips of the leaves in early days. See John White's *Te Rou, or the Maori at Home*. A double slip-knot was so made that when tightly pulled it ran into one large single knot. The Maori brave gave this to the lady of his choice, who signified her consent by pulling the two knots into one.

P. Cookianum. A smaller plant than the typical New Zealand Flax, the leaves being 2 to 5 ft. long with a flower scape 3 to 7 ft. high. There is a pretty variegated form with yellowish-white stripes.

P. tenax, a robust foliage plant with gigantic sword-shaped leaves, roughly 9 ft. long and 2 to 4 in. wide, of a deep dark green colour, the edges picked out with bright red or brown. Stout stems 5 to 10 ft. high bear numerous dull red and yellow tubular flowers. New Zealand.

P. tenax var. *atropurpureum* is a beautiful form with bold reddish-purple leaves. Height 5 to 8 ft.

P. tenax var. *atropurpureum variegatum*. An interesting variety, the foliage delightfully striped in white, purple, green and rose colour.

PHYSOSTEGIA (Labiatae) 5 sp. Name in Greek meaning bellows covering, referring to the inflated fruiting calyx. False Dragon Head.

North American species and their varieties may be naturalised along stream banks and in wet ground, planted in masses for bold effects. They grow 1 to 4 ft. tall, with neat, serrated foliage and showy spikes of pink or purple flowers. Propagated by division; the clumps should be frequently divided to encourage flowering.

P. virginiana (*P. virginica*) (False Dragon's Head; Obedient Plant; Lion's Heart). A hardy, vigorous plant of erect growth, with oblong lanceolate leaves and showy spikes of rosy-pink Dracocephalum-like flowers appearing at intervals from July to September. North America.

P. virginiana var. *alba*. A white counterpart of the preceding.

P. virginiana var. *speciosa*, a tall form (4½ ft.) with densely paniced spikes of showy rosy flowers.

P. virginiana var. *Vivid*. The finest variety yet raised, an extremely free-flowering form with rich rosy-crimson blooms. In artificial light the cut flowers become deep rose and glow with a richness of colour unrivalled by any other plant we know of. This plant is invaluable in the autumn for the gay effects it imparts to the garden, especially as there is a scarcity of this colour at such times.

PODOPHYLLUM (Berberidaceae) 5 sp. Name shortened by Linnaeus from Tournefort's Anapodophyllum, duck's-foot-leaf, because of a supposed similarity in the foliage. May Apple; False Mandrake.

Curious, shade-loving perennials which require a moist situation in loam and leafmould, and are most attractive when colonised in groups. The fruit (May apple) is about 2 in. long and

coral-red; it is edible but has little flavour. The roots are used medicinally.

P. emodi (*P. hexandrum*) has large, three-lobed, umbrella-like leaves which are of a rich bronzy-red shade in spring, becoming light green with black blotches as they age. The creamy-white flowers have an unpleasant smell and are succeeded by large, tomato-like, scarlet fruits in late summer. The foliage is said to be edible. Height 15 in. Himalayas.

P. emodi var. *major* grows about 6 in. taller than the type.

P. peltatum (Lemon Apple). A shade-loving species growing 12 to 18 in. high, with white flowers, and yellow fruits in July. The leaves are pale green, passing to orange-bronze with maturity. A valuable drug is prepared from the rhizome, but the leaves are poisonous and the whole plant narcotic. North America.

POLYGONUM (*Polygonaceae*) 275 sp. Greek, meaning many jointed. Joint weed; Knotweed; Smartweed. See also page 115.

A genus of strong-growing annuals or perennials, often decorative, but inveterately persistent when once established and apt to become weedy. They need little care after planting and are propagated by seeds or division.

P. affine comes from the Himalayas, where it grows on the river banks and hangs in rosy clumps from the moist precipices. It attains a height of 18 in., with radical oblanceolate leaves and dense erect spikes of tiny rose-red flowers.

P. amplexicaule (Mountain Fleece) blooms in midsummer with spikes of bright scarlet, sorrel-like flowers. Height 2½ ft. Himalayas.

P. Bisorta (Snakeweed; Bistort), a weedy plant for moist spots in the wild garden; growing 1 to 2 ft. high, with spikes of pale pink flowers. The rootstock, being highly astringent, was once used medicinally, whilst the fresh shoots have been eaten as food in times of scarcity. In the north of England they were consumed under the name of Easter Dock, and about Manchester, substituted for greens and called Patience Dock. Europe, incl. Britain; North Asia.

P. campanulatum. A strong-growing plant with elliptic, distinctly-veined foliage, dark green above, silvery or buff beneath, and graceful sprays of heather-like flowers, these being white flushed with pink. It hails from the Himalayas and is in flower the whole of the late summer. Height 3 ft.

P. sachalinense. A vigorous-growing plant from the Island of Sakhalin, which sometimes attains 12 to 16 ft. in height. The bright green leaves are oval oblong, frequently a foot or so in length, whilst the greenish-white flowers are borne in axillary clusters. It is a useful subject for quickly covering an ugly rough spot in the wild garden.

POTERIUM (Rosaceae) 1 sp. Greek name for a prickly and downy long-branched shrub with small white flowers, the root of which being made into a drink was good for muscle troubles, hence the name may have been taken from the Greek (*poterion*) for a drinking cup. Burnet.

P. obtusum is a fine Japanese species, with long, pinnate leaves and arching sprays of brilliant rose, drooping, bottle-brush-like flowers. Height 3 ft.

P. obtusum var. *album* has white flowers. Propagated by division.

PRATIA (Campanulaceae) 16 sp. After Monsieur Prat-Bernon of the French Navy, who with Freycinet first discovered the plant.

P. angulata (Lobelia littoralis). A pretty little creeping plant for wet, shady localities, covering the ground with the small green leaves which are spangled with white Lobelia-like flowers. In autumn these are succeeded by purplish-red berries, when the plant bears some resemblance to *Nertera depressa*. It likes a cool moist soil and is propagated by divisions. New Zealand.

P. begonifolia is similar to the preceding, but with green flowers marked with pink. Himalayas.

PRIMULA (Primulaceae) 250 sp. Name derived from *primus*, the first, because of the early flowering of *P. veris*. Primrose.

The majority of Primulas require a rich, cool and retentive soil; one which is continually moist without becoming sodden. They will not tolerate sourness, so that the water should be continually moving beneath the ground, keeping it in a damp yet sweet condition. An effective way of ensuring drainage is to excavate the soil about 2 ft., then put down a 5 to 6 in. base of broken brickbats, clinkers and such like porous material, following this up with 18 in. of good soil. Primulas, being hungry feeders, need a rich compost, so that well-rotted stable manure and leafmould may be incorporated into the soil with advantage. Lime should only be added to suit individual requirements.

A bright and colourful genus, the bog Primulas provide us

with some of our finest waterside flowers. To create the finest effects they should be colonised in large patches, letting some taller-growing subjects divide one sort from another. Thus, each dainty flower spike accentuates the charm of the others, and, if allowed to seed around the parent plant, often produces offspring which differs considerably, both in form and colour, from the original stock. Propagation is effected by division or seed, the latter sown soon after ripening as it quickly loses its vitality. It is best sown in shallow boxes, in a compost of two parts loam, one part sand and two parts leafmould, and should be but barely covered, or it will fail to germinate. The seed trays can then be stood in an outside frame, with shading provided whenever necessary. Germination takes about four weeks and as soon as the seedlings are large enough to handle, they can be pricked out into boxes and from there on to their permanent positions.

P. alpicola (*P. microdonta* var. *alpicola*) is a fine alpine species from Thibet, with large, pale yellow, drooping flowers and long-petioled leaves. Height 2 ft.

P. alpicola var. *violacea* has violet or purple flowers.

P. aurantiaca is a dwarf Chinese species, growing 9 in. high, with reddish stems, dark green leaves and orange-red flowers.

P. Beesiana. A beautiful Chinese bog Primula, producing whorls of fragrant rosy-carmine flowers from May to July. It seeds freely, the youngsters showing many interesting breaks in colour. Height 2 ft.

P. Bulleyana collected by Forrest in China, where it is said to cover whole meadows with the buff-orange flowers. Grown in close proximity to water it reaches 1½ to 2 ft. in height, with thin, papery leaves. This species also produces variable hybrids.

P. burmanica bears stout, upright stems with whorls of crimson-purple blooms in June and July. Height 2 ft. Himalayas.

P. denticulata is the common Himalayan Primrose: a plant of robust growth, attaining 1 or 2 ft. in height. It produces bold tufts of coarse foliage, from which emanate, on stout stems, large globular clusters of lilac blossoms. The flowers are said to be eaten in their native habitat as a salad.

P. denticulata var. *alba* is a pure white form.

P. denticulata var. *cashmiriana* (var. *cachimiriana*) grows 18 to 24 in. high, having mealy leaves and rich purple flowers with yellow centres.

P. denticulata var. *Ruby* is a handsome variety with deep purplish-red flowers and large, smooth foliage.

P. Florindae resembles a giant cowslip and will grow in full sun, providing that the roots are within easy access of water. Reaching 3 ft. in height, the heart-shaped leaves are as large as those of a marsh marigold, whilst the giant heads of soft yellow flowers appear in July and August. Thibet.

P. helodoxa. A magnificent plant of strong growth, producing stout stems carrying several whorls of rich yellow blooms. Height 3 ft. China.

P. japonica. Sometimes called the Queen of Primroses, this is perhaps the showiest and most satisfactory group for the water-side. Not at all tender, they grow easily and freely in moist, shady spots, throwing up tier after tier of white, pink or crimson blossoms for several weeks in succession. Strictly speaking, the type is crimson, but if allowed to set seed, many forms and shades will appear. Height 2 ft. Japan.

P. mollis, from the Himalayas, requires a moist or boggy situation. It is a beautiful species, downy throughout, the bright rose flowers having vivid red calyces. Height 12 to 16 in.

P. pulverulenta resembles *P. japonica* in general habit, but is distinguished by the mealy stems which carry whorls of rich crimson blooms. A varietal group known as 'Bartlet Strain' gives many attractive colours: buff, apricot, rose-pink and salmon hues being found, with all the intermediate shades. Blossoming in May, they remain in character many weeks, and are particularly suitable for situations in the lower part of the rock garden, or along streams. 3½ ft. China.

P. pulverulenta var. *Red Hugh* is a charming variety of the type, with bright crimson flowers in May and June. Height 2 ft.

P. rosea. A beautiful little alpine Primula from the Himalayas, growing only 6 or 9 in. high, with tufts of pale green foliage and loose umbels of clear rose flowers (borne in heads like Polyanthus) appearing in early spring.

P. sikkimensis (Himalayan Cowslip). One of the most beautiful of the genus, found in wet, boggy localities at altitudes of 11,000 to 15,000 ft., where it covers acres of land with the soft yellow blooms, extending along the Himalayas from Nepal to Burma and into China. From rosettes of long, narrow leaves emanate slender stems of fragrant, nodding, pale yellow flowers—each bloom

roughly 1 in. in length and $\frac{1}{2}$ in. across. They remain in character for several weeks. Height 2 ft.

P. Veitchii. A Chinese species, growing 1 ft. high, with globular heads of rose or pink flowers.

P. Waltonii bears deep ruby-red flowers on stems powdered with a mealy farina. The species is newly introduced from Thibet and is free-flowering. Height 18 in.

PYROLA (Pyrolaceae) 15 sp. Name, a diminutive of *pyrus* or *pirus*, pear, from some fancied resemblance in the leaf. Winter Green (in part: see Gaultheria). Shin Leaf.

Low-growing plants with dark green leaves, which are bitter-sweet and have great medicinal properties. The plants are often difficult of cultivation, but grow naturally in sandy woodlands, so should be afforded similar treatment with some shade. Propagation by division.

P. asarifolia has almost round, shiny, crenulate leaves and spikes of nodding, purple or rose flowers. Height 12 to 18 in. Swamps of North America and Asia.

P. rotundifolia. A rare native, forming carpets of evergreen, shining foliage: the leaves thick and leathery. Erect stems carry ten to twenty pure white drooping blooms; the flower-spike somewhat resembling that of a lily-of-the-valley. Height 6 in. Europe, incl. Britain; N. Asia.

P. uliginosa (*rotundifolia* var. *uliginosa*) (Bog Wintergreen) grows 6 to 15 in. high with thick, dull green, broadly ovate leaves and slender spikes of small rosy flowers. Asia; N. America.

RANUNCULUS (Ranunculaceae) 300 sp. See also pages 117 and 166.

The genus is for the most part of the simplest culture: the bog species being easily grown in moist, friable loam in full sun. Propagation is effected by seeds or division.

R. aconitifolius. A stout perennial bearing a profusion of single white flowers on branched stems. The leaves are dark green and palmately divided. Europe.

R. aconitifolius var. *flore pleno* (Fair Maids of France and Kent; White Bachelor's Buttons), with double flowers, is the more decorative form and delights in a moist spot at the waterside.

R. acris var. *flore pleno* (Yellow Bachelor's Buttons; Gold Knots). The double form of the common buttercup, with its glossy, button-like rosettes, makes a pretty waterside subject.

R. bullatus var. *flore pleno* grows about 9 in. high with large, double, orange-yellow flowers which are something like those of the double marsh marigold (*Caltha palustris* var. *plena*).

R. gramineus, with linear grassy leaves and yellow, buttercup-like flowers, grows 6 to 12 in. high. There is also a double form of the type. S.W. Europe and Morocco.

R. platanifolius. A most beautiful plant with showy palmate foliage and exceptionally large, caltha-like flowers. These are pure white with golden-yellow stamens. When grown in shallow water the plant attains a height of 3 to 4 ft., becoming shorter in proportion in a moist or dryer situation. It is a fine species and deserves to be more widely known. Europe.

RHEXIA (Melastomaceae) 7 sp. Name from *rhexis*, a rupture; application not obvious. Meadow Beauty; Deer-grass.

Handsome bog plants requiring sunny, swampy situations, where they soon make good clumps. Propagation by division of the tubers or by seed; the plants should not be disturbed too often and are only hardy in sheltered positions.

R. aristosa grows from 18 to 24 in. high, carrying small, oblong, sessile leaves and magenta, four-petalled, single blossoms, each from 1 to 1½ in. broad. It hails from New Jersey swamps, where it is sometimes found actually in water.

R. ciliosa is not as attractive as most of the genus and carries scattered, violet-purple flowers with small, oval leaves in pairs all the way up the stem. Height 18 to 24 in. Florida.

R. lutea has very branched stems and yellow flowers.

R. mariana. A slender, erect plant, growing about 2 ft. high, with small, hairy, oblong leaves. The flowers are borne in cymes and are about 1 in. broad—of a purplish-red colour—and appear at intervals from June to September. New Jersey swamps.

R. virginica, the commonest species, is of compact, bushy habit and thrives equally well in clayey and peaty soils. It is a pretty little plant with vivid rose flowers. Height 6 to 8 in. North America.

RHEUM (Polygonaceae) 50 sp. From *reon*, ancient Greek name for a plant with a stout root of value in medicine; also called *Rha* or *Rha Ponticum*, which grew on the banks of the River Rha, now the Volga. Rhubarb.

Handsome foliage plants of tropical magnificence, particularly adapted to semi-wild places and at the margins of water courses. Planted in rich, moist soil they can be left to look after

themselves, and increase yearly in vigour and picturesque beauty. Propagation by seed or division.

The genus is important, apart from the extensive use made of the leaf-stalks of *R. Rhaponticum* as a substitute for fruit in spring, on account of the medicinal rhubarb obtained from Chinese species. For long the source of this was doubtful, the Chinese and Tartars being loth to divulge it. *R. palmatum* and *R. officinale*, cultivated in western China and adjacent Thibet, are now known to be the sorts used; their rhizomes are stripped of the bark and roots and then dried. Nearly all the genus have great medicinal virtues and some are made into wine and preserves.

R. Alexandrae. A striking plant, not easy to cultivate, with dark green, comparatively small, glossy leaves and a leafy flower stem, remarkable for the large, reflexed, straw-coloured bracts roofing the flowers. Height 3 to 4 ft. W. China.

R. emodi. A fine foliated subject with broadly ovate, wrinkled leaves of a bronzed-copper hue and large red veins. The flower-spike is dark purple and attains 5 to 10 ft. in height. Himalayas.

R. inopinatum. A dwarf species seldom attaining more than 2 ft. in height. The leaves, clustered together at the crown of the plant, have bright red stems and veining; whilst the feathery heads of inflorescence are scarlet. These are produced in succession, so that the plant is in character all the summer. Thibet.

R. officinale. A stately Chinese species with palmately-lobed leaves 1 to 3 ft. across and gigantic spikes of greenish-white flowers. Height 8 to 10 ft. China.

R. palmatum. A slow-growing plant with gigantic, deeply-cut, five-lobed leaves and tall panicles of creamy-white flowers. Height 8 to 10 ft. with maturity. Thibet and adjacent China.

R. palmatum var. *atrosanguineum* has more deeply-dissected leaves, and rich crimson flowers and fruit. Kanso.

RODGERSIA (Saxifragaceae) 6 sp. Named in honour of Commodore Rodgers of the U.S. Navy, commander of an expedition to Japan in 1855, who discovered the type plant *R. podophylla* near Hakadate.

Decorative foliage perennials with thick, scaly rhizomes and long, feathery panicles of fluffy, white, Astilbe-like flowers. Best results are obtained by planting the roots in a damp (not wet) position near the waterside, in a rich, peaty soil, and a shady situation. Propagation by root cuttings or division.

R. aesculifolia grows about 4 ft. high; the large basal leaves divided into six to seven segments, like those of the horse-chestnut, are as much as 18 in. across with shaggy, brown hairs clothing the veins. Small white flowers are packed tightly together, forming handsome (18 to 24 in. long) sprays of Astilbe-like appearance on stems 3 ft. high. China.

R. pinnata. A tall, hollow-stemmed plant with dark olive-green leaves—divided into narrow leaflets—and branched panicles of rosy-red blossoms. Height 2 to 3 ft. China.

R. pinnata var. *alba* has white sprays of flowers. Height 2 ft.

R. pinnata var. *elegans* is much finer than the type, with bronzed foliage and rich rose blooms.

R. podophylla (Rodger's Bronze Leaf), discovered in Japan in 1855, was long thought to be the only representative of the genus. It has large bronze-green leaves, palmately divided into five to seven divisions—somewhat resembling those of the horse-chestnut. The inconspicuous, yellowish-white flowers are borne on dense branching spikes. Japan.

R. Purdomii is a recent Chinese introduction, growing 2 to 3 ft. tall, with creamy-white flowers and bronzed palmate foliage.

R. sambucifolia has large bright green leaves—divided like an elder leaf—and heavy panicles of creamy-white flowers. Height 2 to 3 ft. China.

R. tabularis (*Astilboides tabularis*) is quite distinct and grows about 3 ft. tall; the pale green leaves being very long petioled, 2 to 3 ft. across, and almost round. The flowers are creamy-white. China.

SABBATIA (Chironia) (Gentianaceae) 12 sp. Dedicated to Liberato Sabbati, an eighteenth-century Italian botanist who had charge of the Rome Botanic Garden.

A genus of monocarpic or perennial plants native to Cuba and North America: very pretty when in flower with elegant white, pink or rose blooms. They may be freely reproduced by seed, which should be sown in shallow pans stood in bowls of water.

S. angularis (Rose-Pink). A pretty little plant of pyramidal habit, having abundant rose-pink, or occasionally white, flowers with a yellow or greenish eye. These are usually 1 to 2 in. across and sweetly scented. Height 12 to 24 in. North America.

S. campanulata (Marsh Pink). A dainty plant found in fresh and salt water marshes in Florida and Cuba. A slender species, it is

of branched habit, growing 1 to 2 ft. high, with a profusion of pink blooms having yellow eyes.

S. dodecandra (chloroides) (Large Marsh Pink) thrives in wet, boggy soil, and grows from 1 to 2 ft. high. The flowers are pink or white and $1\frac{1}{2}$ to $2\frac{1}{2}$ in. across. Florida.

S. lanceolata grows 1 to 3 ft. high with branching stems, simple ovate leaves about 1 in. in length, and five-petalled white flowers. New Jersey swamps.

SANGUISORBA (Rosaceae) 30 sp. Name possibly coined by Fuchs, from *sanguis*, blood, and *sorbere*, to drink up or absorb; from reputed styptic properties.

S. canadense (Poterium canadense). A fine North American plant for a wet, swampy position, growing 1 to 5 ft. high, with green, rose-like foliage and attractive, erect spikes of feathery white flowers. It is sometimes used for a salad plant—having a taste not unlike that of cucumber.

SAXIFRAGA (Saxifragaceae) 325 sp. Name in Latin meaning 'breaking stone', because many of the species grow in rock clefts.

A large genus propagated by seed or division.

S. aquatica (ascendens). A robust, little, creeping plant from the river sources in the high mountains of the Pyrenees. It grows 8 to 9 in. high, forming thick mats, with slender panicles of white flowers and small three-lobed leaves. The plant likes to be situated above the water, where the roots may grow down into the moisture.

S. Hirculus (Leptasea Hirculus). A pretty little bog plant from Arctic America, suitable for very cold, damp situations. Growing 4 to 10 in. high, the erect stems carry small, alternate, linear leaves and bright yellow five-petalled flowers with scarlet spots.

S. Hirculus var. *grandiflora* has bright golden blossoms 1 in. or more across. It is freer flowering and more desirable than the type.

S. micranthidifolia (*S. erosa*; *Micranthes micranthidifolia*) (Lettuce Saxifrage). A handsome erect plant which will flourish in or near the water; with toothed, fresh-green, lettuce-like leaves and densely packed panicles of yellow and white flowers. Height 2 to 3 ft. Cold brooks in North America.

S. peltata, now generally recognised as *Peltiphyllum peltatum* (Umbrella Plant), is distinct amongst the Saxifrages: with huge peltate leaves often more than a foot across and 2 to 3 ft. high. The white or rose-coloured flowers appear in spring before the

leaves, borne on stems 1 to 2 ft. high. It is a most desirable subject for naturalising along the banks of streams, quite hardy, and favours a deep, moist soil. California.

S. peltata var. *maxima* is a more vigorous and larger-growing form than the type.

S. peltata var. *nana*. A pigmy form, growing 12 in. high, with pink flowers and dark green foliage which turns bronzy-orange in autumn.

S. pennsylvanica (*Micranthes pennsylvanica*) (Swamp Saxifrage) grows 2 to 3 ft. high, with large oval leaves, a thick rhizome, and dense cymes of greenish flowers. North American swamps.

SCHIZOSTYLIS (Iridaceae) 2 sp. Name in Greek meaning style and cut; alluding to the capillary style segments.

S. coccinea (Crimson Flag). One can hardly term the Schizostylis bog plants, and yet in Viscountess Byng's garden at Thorpe this species is revelling in a boggy situation by the waterside, even under 2 or 3 in. of water. The experiment would be worth repeating as such a lovely subject could not fail to grace our water gardens. It is a handsome bulbous plant with the habit of a *Gladiolus*, growing 1 to 2 ft. tall, with several basal leaves and scarlet heads of flowers. S. Africa.

SEDUM (Crassulaceae) 450 sp. Name from the Latin *sedes*, to sit.

S. villosum is one of the few species of this extensive genus that is suitable for the bog garden. Growing 3 to 4 in. high, it bears small green leaves and terminal cymes of white or rose flowers. An annual. N. Europe.

SENECIO (Compositae) 2000 sp. Name from the Latin *senex*, an old man, alluding to the hoary pappus. See also page 120.

Showy, robust plants comprising the largest genus in the world. The boggy sorts are particularly suited to wild garden settings and are readily propagated by seed or division.

S. aquaticus (Marsh Ragwort). A common native suitable for the wild garden, growing 2 ft. high with coarse, toothed leaves and loose corymbs of golden blooms.

S. clivorum (*Ligularia clivorum*). A decorative Chinese species with large, shining green leaves which are often 20 in. across. Stout stems carrying crowded heads of rich orange flowers are produced at intervals from July to September. Height 3 ft.

S. clivorum var. *Orange Queen* has larger blooms than the type: these being of a deep orange shade.

S. paludosus (Great Fen Ragwort). A large aquatic plant, growing 2 to 6 ft. high, with lanceolate, serrated leaves which are downy beneath; and large heads of bright golden flowers. We have occasionally seen the plant growing in several inches of water, where it created a most imposing effect. Europe, incl. Britain (a rare native).

S. palustris (*Cineraria palustris*) (Marsh Fleawort). A stout plant with a hollow stem, growing 12 to 24 in. high, the pale yellow flowers being borne in a corymb—like those of a *Cineraria*. Europe, incl. Britain (rarely); North America; Asia; Greenland.

S. pulcher. A showy subject, suitable for the margins of streams and ponds, with a bold, erect habit, and large flowers in late summer. Growing 2 to 3 ft. high, the stems terminate in crowded heads of crimson-purple flowers, each having a conspicuous yellow disk. It succeeds best in moist, sunny positions in rich soil and is quite hardy. Buenos Ayres.

S. Veitchianus (*Ligularia Veitchiana*). A stout perennial with cordate foliage (15 to 16 in. long) and branching panicles carrying ten or twelve golden flowers. These are of good size, being 1 to 2 in. across. Height 3 to 6 ft. Central China.

S. Wilsonianus (*Ligularia Wilsoniana*) (Giant Groundsel). A handsome Chinese species, very desirable for the bog garden. The flower stem grows 3 to 5 ft. high, carrying a profusion of rich golden blossoms. The leaves are rounded to heart-shaped, often 10 to 20 in. long by 9 to 10 in. broad, and deeply toothed.

SIBTHORPIA (*Scrophulariaceae*) 6 sp. Named in honour of Humphry Sibthorp (1758-1796), Professor of Botany at Oxford.

S. europaea (Cornish Moneywort). An elegant little native creeper with slender, thread-like stems and delicate, downy, orbicular leaves. The small yellow and pink axillary flowers are inconspicuous, but the plant is useful for carpeting moist soil. A variegated-leaved form is more decorative but less hardy; a warm bank suits it—or it may be planted around the indoor pool. Propagated by division.

SIDALCEA (*Malvaceae*) 12 sp. From *Sida* and *Alcea*, ancient Greek names used by Dioscorides for some allied genera.

S. candida. A pretty, free-flowering Mexican species which is adapted for waterside planting, with palmately divided buttercup-like foliage, and terminal racemes of snow-white blossoms. Height 2 to 4 ft. Propagated by division.

S. malvaeflora. A tall-growing plant with small, green, five-divided leaves and heads of purple flowers. Height 2 to 6 ft. or more. The species has given rise to many horticultural varieties, of which the following comprise the best.

atropurpurea, large open purple flowers. Height 2 to 3 ft.

Listeri, satiny-pink blooms. Height 3 ft.

Lowfield Pink, soft flesh-pink. Height 3 ft.

Nimmerdor, crimson-purple. Height 3 ft.

Rev. Page Roberts, soft pink. 2 ft.

Rose Queen, bright rose. Height 4 ft.

Sussex Beauty, light pink. $3\frac{1}{2}$ ft.

SISYRINCHIUM (Iridaceae) 75 sp. Old Greek name originally applied to some other plant. *Satin Flower*; *Rush Lily*.

Iridaceous perennials from North America: with grassy foliage and umbellate clusters of bell-shaped, purple or yellow flowers. They are best cultivated in a light, moist, sandy soil and are propagated by division.

S. californicum has yellow bell-shaped blossoms lined with brown. It is not quite as hardy as the following species and needs some protection in winter. Native to Californian swamps.

S. Douglasii (*S. grandiflorum*) is the best of the genus, with bright purple drooping flowers, each about $\frac{3}{4}$ in. across. It blooms in May and June and grows 12 in. in height. N.W. America.

S. grandiflorum var. *album* has white flowers.

SMILACINA (Liliaceae) 20 sp. Meaning resembling smilax. *False Solomon's Seal*.

Handsome plants with feathery panicles of *Spiraea*-like flowers and lily-of-the-valley leaves, which prefer a rich, shady soil and a moist (not wet) locality. They should not be disturbed too often and are propagated by division.

S. racemosa (*Vagnera racemosa*) (*False Spikenard*). A good subject for the bog garden, flowering in May, with loose sprays of fragrant white blossoms followed by rosy-purple berries. The pale green leaves are 2 to 6 in. in length. Height $2\frac{1}{2}$ ft. North America.

S. trifolia (*Vagnera trifolia*) grows 10 to 12 in. high, with oblong, lanceolate leaves and simple racemes of white flowers. Bogs in North America and Asia.

SOLIDAGO (Compositae) 90 sp. Name from *solido*, to join or

make whole, in allusion to the reputed healing qualities of the plant. Golden Rod.

A coarse but grand genus of autumn-flowering perennials which are indispensable for naturalising in many situations, as by roadsides, borders or woodland—no spot so rough but will harbour some member of the genus. At the side of the stream or in the wild garden, planted in company with purple asters, they become particularly large and fine, providing a brave and gaudy show for many weeks. Propagation is effected by division.

The genus has some economic value, for *S. odora* yields by distillation a sweet-smelling, essential oil. Before civilisation swept across the great American continent, the thrifty Canadian housewives would gather the flowers of the Golden Rod and use them to dye their yarn bright colours. The species are less rarely grown than the many fine garden varieties now obtainable, of which the following comprise the best.

Frühgold is of compact, bushy habit, with sharply-serrated, lanceolate leaves and rich golden plumes of flowers. Height $2\frac{1}{2}$ ft.

Gold Else has orange-yellow flowers and grows $2\frac{1}{2}$ ft. high.

Golden Wings has arching sprays of rich golden inflorescence. Height 4 to 5 ft.

Sonnenschein grows 3 ft. in height with clear yellow flowers.

Spätgold, a favourite variety with loose, feathery heads of rich yellow blooms. Height 3 ft.

SPIRAEA. See page 236.

SWERTIA (Gentianaceae) 90 sp. Named after Emanuel Sweert (b. 1552), a famous Dutch bulb grower. Felwort.

S. perennis (Marsh Felwort). An alpine bog plant favouring a moist, peaty situation and growing 8 to 9 in. high. It has erect spikes of flowers, which are greyish-purple spotted with black, and oblong, long-petioled leaves. Propagated by division. Europe; Asia.

SYMPLOCARPUS (Araceae) 1 sp. Name from *symploke*, connection, and *karpus*, fruit; alluding to the union of the ovaries into a compound fruit. Skunk Cabbage.

S. foetidus (Spathyema foetida). A curious North American plant having a foetid odour when bruised, similar to that of the skunk. The hooded spathes, 3 to 6 in. high, usually grow in

clumps and show a delightful range of colour, being mottled with purple and yellowish green—changing in part to crimson, dark green and yellow. They appear very early in the spring—several weeks before the foliage shows—and remain in character for months. The leaves are numerous and very large, being 1 to 3 ft. long and often 1 ft. wide, and are roughly heart-shaped with thick and prominent veins. The Skunk Cabbage is an interesting plant for the bog garden and will thrive in wet, marshy positions. The roots and seeds have powerful medicinal properties. Propagation is effected by division.

SYNANDRA (Labiatae) 1 sp. Name in Greek meaning together, and *anther*, referring to the constitutional anthers.

S. hispidula (*S. grandiflora*). A hairy, nettle-like plant, growing 1 to 2 ft. high, with pretty, yellowish-white, tubular flowers—each about 1½ in. in length. The plant is a biennial and reproduced by seed. Found by shady stream-banks in N. America.

TETRAGONOLOBUS (Leguminosae) 7 sp. Name from the Greek *tetragonos*, four-angled, and *lobos*, a pod; with reference to the four-angled fruit.

T. siliquosus (*Lotus siliquosus*). A procumbent species with five-parted leaves and handsome, yellow, pea-shaped flowers. Propagated by division. Europe.

TRADESCANTIA (Commelinaceae) 35 sp. Named in honour of 'that painful industrious searcher and lover of all nature's varieties', John Tradescant (d. 1637), gardener to Charles I. Spiderwort.

A fine genus of hardy border perennials which will flourish in moist, shady positions at the waterside, producing three-cornered gaudy flowers, in terminal heads, over a long period in summer. The individual blooms only last a day. They are propagated by division or from cuttings.

T. canaliculata (*T. reflexa*). The most common and widely spread species, with linear-lanceolate leaves and terminal umbels of flowers ranging from purple and blue to rose. We have successfully grown this species in several inches of water. North America. 2½ ft.

T. virginiana (*T. virginica*) (Common Spiderwort). An erect, branching plant with long, narrow leaves (6 to 15 in. in length) and violet flowers about 2 in. across, which are freely produced all the summer. This species and its hybrid derivatives include many distinct colour forms, among the following:

alba, pure white. 2 ft.

Iris Pritchard, white stained with blue.

J. C. Weguelin, light azure-blue.

purpurea, purple.

rosea, soft rose. Height 2 ft.

rubra, dark rosy-pink or red.

violacea, purple-blue or violet.

TRILLIUM (Liliaceae) 30 sp. From *triplex*, triple; alluding to the triple parts of the flowers and leaves. Three-leaved Nightshade; Wake Robin; American Wood Lily; Indian Shamrock; Birthroot; Ground Lily.

Trilliums are delightful little plants for naturalising in moist, shady spots beneath the taller denizens of the water garden. They thrive in rich mould: and for imposing effects should be planted deeply and in large clumps. From short, thick rhizomes arise the glossy, three-lobed leaves; the extended petiole carrying solitary white or purple, three-petalled flowers. Propagation by seed sown directly after ripening.

T. cernuum bears nodding, white, narrow-petalled blooms. Height 1 ft. North America.

T. erectum. An evil-smelling species: the reddish-purple flowers succeeded by oval, reddish berries. Height 8 to 12 in. The white fleshy roots are employed in medicine; tannin and bitter extract being two of the chief ingredients derived from it. North America.

T. grandiflorum is the largest flowered member of the genus, with pure white blooms 2 to 3 in. across. These often change to pink as the flowers age. Var. *roseum* with pink blooms is sometimes cultivated. Height 12 to 18 in. North America.

T. ovatum is much like *T. grandiflorum* but earlier flowering and with narrower petals. North America.

T. recurvatum is a free-growing species with small, brownish or dull purple flowers. Height 9 to 12 in. North America.

T. sessile is distinguished by the flower having no stalk and sitting direct on to the leaves. It is small, pleasantly scented, and of a crimson-purplish or greenish colour. Height 1 ft. North America.

T. sessile var. *californicum* has tubular flowers—sometimes 4 in. in length—of a white or purplish-rose colour sitting direct

on the foliage. The individual leaflets may be 5 or 6 in. long and are green, freely spotted with purple.

T. sessile var. *rubrum* is a pretty form with deep crimson blooms.

T. stylosum (*T. nervosum*; *T. Catesbaei*) grows 12 to 18 in. high with rose-coloured blooms. North America.

T. undulatum (*erythrocarpum*) (Painted Wake Robin) has white flowers suffused with purple veins or stripes, and shiny red berries. Height 1 ft. North America.

T. Vaseyii. A strong-growing species attaining 18 in. or more in height, with very large, dark purple flowers. North America.

TROLLIUS (*Ranunculaceae*) 20 sp. The name *Trollius* is sometimes said to be connected with the Scandinavian word *troll*, a malignant supernatural being; it originated, however, with a Swiss naturalist, Conrad Gesner (1516-1565), who, in a Latin description of the Pilatusberg, latinised the local German-Swiss name *Trollblume* as *Trollius flos*. The word *Trollblume* is now regarded as derived from an old Teutonic verb *trollen*, to roll, in allusion to the rounded blooms. Globe Flower.

Trollius are grown for the beauty of their large, round, buttercup-like flowers and dark green leaves; and may be planted by the borders of ponds, streams or in any such wet places. All are of dense habit of growth: the blooms and foliage arising from thick underground roots which do not possess the rambling habits that mar so many otherwise excellent plants. They are spring bloomers, at their best in May and June; but an occasional second crop will sometimes appear on established plants. Propagated by division in September or March: few plants are so susceptible to decay when newly moved, so that, although desirous of rich feeding, they should not be allowed to come into contact with manure until well established.

T. acaulis. A charming dwarf bog plant, rarely exceeding 3 to 4 in. in height, with lemon-yellow flowers just above the ground level, and green buttercup-like leaves. N. India.

T. asiaticus is very much like *T. europæus* only taller, with bronzed divided foliage and rich golden-yellow flowers. Siberia.

T. asiaticus var. *giganteus* grows 3 to 3½ ft. high and has pale yellow flowers.

T. chinensis grows freely and will seed itself in the bog garden. The flowers are yellow. North China.

T. dschungaricus. A Russian species much like *T. europæus* but with expanded flowers; the sepals are golden inside and reddish without.

T. europæus (*T. globosus*) grows 18 to 24 in. high, with large, soft yellow, globe-shaped flowers; appearing in succession from May until July. N. Europe.

T. Ledebourii. A pretty Asiatic species with a profusion of rich orange flowers; the sepals more expanded than in some forms, so that the stamens protrude. Height 3 ft. Siberia.

T. Ledebourii var. *Golden Queen* is a fine form of preceding with large saucer-shaped flowers of a brilliant orange shade.

Besides the above species, there are numbers of fine garden varieties that may be included in the bog surround. We append a list of the best sorts.

Etna. A vigorous grower with large, deep orange flowers in May. Height 2 to 2½ ft.

First Lancers has deep orange-yellow blooms in May and June. Height 2½ ft.

Glory of Leiden is golden-yellow. May-June. Height 2½ ft.

Juliana has exceptionally large, deep orange, cup-shaped blooms. 2 ft. May and June flowering.

Orange Crest bears bright orange flowers with orange-scarlet anthers. May and June. Height 2½ ft.

Orange Princess is deep orange. May and June. Height 2½ ft.

Springhill Beauty, orange-yellow flowers in May. Height 2½ ft.

Thora Perry. A dwarf, with golden-yellow blooms in May and June. Height 4 in.

UVULARIA (Liliaceae) 4 sp. Name from the Latin *uvula*, palate, referring to the pendulous flowers. Bell-Wort.

A small genus of pretty, moisture-loving perennials suitable for shady positions at the back of the bog garden, beneath the trees and windbreak. Growing 12 to 18 in. high, the foliage is of a delicate green, which, with the numerous, drooping Solomon Seal-like flowers, renders the plant charming if not showy. Propagated by division.

U. grandiflora bears pretty, bell-shaped, yellow flowers 1 to 1½ in. in length and blooms in May. Height 1 ft. North America.

U. grandiflora var. *pallida*. In this variety the flowers are of paler colour, being a light primrose-sulphur. Height 15 in.

U. perfoliata is similar but slenderer than preceding species, with pale yellow blooms. United States of America.

VERONICA (Scrophulariaceae) 250 sp. Named in honour of St. Veronica. Speedwell.

V. gentianoides. An early-flowering species of compact growth, which forms a dense mat of thickish, oblong leaves, so is useful for a cover plant. It will grow in sun or shade so long as the soil is wet. The flowers are pale blue with darker streaks, and borne on elongated racemes. Height 12 to 24 in. Wet alpine meadows. S.E. Europe.

V. gentianoides var. *alba* is a white-flowered variety.

V. gentianoides var. *variegata* has lavender-white flowers and prettily-variegated foliage. Height 1 ft.

VIOLA (Violaceae). Classical name.

There are quite a number of violets that favour the moist, boggy conditions of the water-garden surround. They need little care after being planted and generally spread quite naturally from seed or runners.

V. blanda (Sweet White Violet). A pretty little species of stoloniferous habit from very wet, swampy situations in North America. It grows 5 to 6 in. high with heart-shaped leaves and fragrant white, purple-veined flowers.

V. canina (Dog Violet). This common native plant may be freely planted around the moist and shaded parts of the water garden, for the beauty of the small blue flowers in early spring. Height 4 in.

V. lanceolata. A profusely stoloniferous species, growing 4 to 6 in. high, with smooth white blooms and narrowly-lanceolate, long-petioled leaves. Along streams, North America.

V. palustris (Marsh Violet) has pale lilac flowers streaked with violet-blue, and thin, heart-shaped foliage. Europe, incl. Britain; Asia; North America.

V. primulifolia bears long, primrose-like foliage and scapes 4 to 10 in. high carrying white, purple-veined flowers. North America.

V. renifolia. A very free-flowering species with large, kidney-shaped leaves, and white and brown flowers. North American swamps.

V. sagittata has attractive arrow-shaped foliage and large dark blue flowers. North American marshes.

WAHLENBERGIA (Campanulaceae) 85 sp. Named in honour of Georg (or Göran) Wahlenberg (1780-1851), professor of Botany at Upsala.

W. hederacea (Campanula hederaceae). A graceful little creeping plant with small, heart-shaped, toothed leaves and tiny, drooping, narrow, bell-shaped, pale blue flowers: associating well with the pink stars of *Anagallis tenella*. West Europe, incl. Britain.

CHAPTER XVII

Aquaria

All precious things discover'd late,
To those who seek them issue forth;
For love in sequel works with fate,
And draws the veil from hidden worth.

ALFRED TENNYSON

THERE are few hobbies which make less demands on time and patience or offer such a rich return as the indoor aquarium. Giving pleasure to young and old, it provides a soothing tonic to tired nerves—as witness the number of aquariums that are now installed in doctors' waiting rooms and hospitals. It is not a new phase: fish in ponds or other receptacles have been kept for centuries. In his Diary, Pepys refers to some 'mighty fine fish' that Lord Sandwich kept in a glass and observed that they 'were like to live for ever'. Few aquarists to-day would be so optimistic!

We find that the Romans had eel ponds and the early English monks stew ponds in which they kept fish, although no attempt seems to have been made to rear them under natural conditions. Chinese records show that the goldfish was first introduced from that country into Japan about 1500 A.D.; which points to early interest in these creatures. The Chinese form was bizarre, characteristic of Chinese art: but in Japanese hands it attained a rare grace and beauty and gradually evolved into the fine varieties we know to-day.

CHOICE OF AQUARIUM

The choice of aquarium is one that should not be lightly made. The old-fashioned globes are unsatisfactory, they cannot be properly planted with oxygenating plants, so that the water needs constantly changing—which cannot be considered good aquarium management. Then again, the globe distorts the view of the fish and, having little water surface, is usually lacking in oxygen content. The square or oblong, metal-rimmed glass container will be found the best, and can be repaired if one of the sides gets

broken; glass accumulator tanks, although often used, are not to be recommended, as these too distort the vision and when once cracked are of no further use. It is as well to purchase as large an aquarium as possible, for it offers more scope and is easier to keep natural in appearance.

POSITION

When setting up the aquarium one has to remember that when full of water it may weigh anything from a half to three hundred-weights (according to size), and consequently a good strong support is needed. A stout table or some such object will answer the purpose, or there are special metal stands on the market constructed specially for the job. Light is essential for the plants, but not strong sunshine to encourage alga growth, so that a north or north-west window suggests itself as the happiest position. During the dark days of winter, when every ray of sunshine should be treasured, a south window will be of value, providing the moving of the aquarium does not entail too much labour. In the absence of a north position, tinted paper can be fastened over the side of the glass nearest the window, or an adjustable blind fixed to cut out excess light.

SETTING UP

The first principle to bear in mind when setting up the aquarium is that it should look natural; castles, mermaids, gaudy coral and stone decorations look ridiculous and detract from the beauty. Such atrocities cannot compare with a few water- or glacier-worn rocks or pebbles, which, skilfully arranged with feathery underwater plants, can be made to resemble some underground river scene or ocean grotto.

Aquarium compost is the next consideration and here there is some diversity of opinion. All our plants are grown in natural loam covered with a layer of sand, and we find that they thrive and do not become yellow or starved unless greatly overcrowded. In the stock tanks they are grown in loam alone, for sand is only necessary when fish are present. At the same time, many authorities advocate planting in sand alone—without loam—and there is something to be said in favour of this method, for many plants will live a long time under such conditions. To the inexperienced such a method is certainly 'less messy', for the waste products of

the fish will nourish the plants to a certain extent. See page 138. However, plants do not grow in sand alone under natural conditions, and we consider the presence of loam necessary after experimenting with both methods. A compromise can be effected by growing the plants in loam in 'Tom Thumb' flower pots: hiding these under mounds of sand. The best sand to use is a mixture of river sand and coarse ballast (run through a quarter-inch sieve). Silver sand packs down too tightly and should be avoided, whilst shingle is too loose and allows particles of food to become lost and decompose.

The bedding medium should be spread over the floor of the tank, about an inch or less in front, rising up to a mound or series of little hills at the back. Decayed food and sediment (known as mulm) will automatically drift to the lowest level (which is in front) and can then be occasionally siphoned out. Directly the compost is arranged, temporarily cover the surface with a sheet of paper and slowly add enough water to half fill the aquarium, when planting operations may begin. A pencil makes an excellent dibber for those subjects which have to be planted, although *Fontinalis*—usually attached to a stony or woody host—can be just placed in position. Generally speaking, the taller plants should be arranged at the back and a fair amount of open space left towards the front and middle. Except during the breeding season the fish will make no attempt to swim through a bank of greenery, and zealously circumvent all such obstacles. After planting, fill the tank very slowly to within two inches of the top, and gently drop the floating plants on the surface.

INTRODUCING THE LIVESTOCK

At this stage of the proceedings the aquarium should be crystal clear and the plants well anchored and attractively arranged. The next item concerns populating the tank with livestock and getting the whole thing properly balanced—no easy proposition. The most common cause of failure is overcrowding, and this may equally well be affected by plant or animal life. The presence of too many fish means that the water is overcharged with carbon-dioxide whilst a superabundance of plant life causes much the same effect. This sounds contradictory, but the following facts may explain.

In the presence of daylight, strong sunlight or electric light

the green parts of a plant perform an operation known as photosynthesis, which compares with eating and breathing in animals. By the means of carbon-dioxide (which it absorbs) and water, it forms starches which enable the plant to grow and at the same time releases free oxygen. This occurs only in light and more markedly during sunlight, so that on bright days there is abundance of oxygen for the fish. At the same time various parts of the plant perform respiration, which means that they take in oxygen and release carbon-dioxide—although the quantities involved are so small as to have little effect in the aquarium under normal conditions. Imagine the absence of strong light for some time in a well-planted tank and it will be realised that as fish and plants are both oxygen breathers there will be a resultant loss of balance in the aquarium. Fish rise to the surface at evening, and we now know that they do not do this (as at one time supposed) for resting purposes, but because the water thereabouts is richest in dissolved oxygen.

Disastrous results from heavy plantings are not immediately apparent: a fish can draw on reserve oxygen in the blood stream for a considerable time or exist in water with a low oxygen content for weeks, but the vitality is steadily being lowered and death ultimately ensues. How then shall we obtain a balanced aquarium? We shall not endeavour to do so. It is better to have a high oxygen content always present and to give our plants the greatest possible amount of light during the dull days. When this seems insufficient, an ordinary light bulb may be suspended over the tank, or failing this the number of fish should be reduced. Of course, artificial aeration by means of a mechanical installation is another solution, and there are many aerators on the market for the purpose.

With regard to the number of fish that can be safely introduced to the aquarium, there are two methods of calculation. One is to allow an inch of fish (excluding the tail) to one gallon of water and the other to apportion one inch of fish to six square inches of water surface area. These are good rules to work on, but one must make allowance for growth, and leave some margin. If the fish come to the top of the water in daylight and gurgle air and water, it is safe to say that they are overcrowded and should be afforded more space.

ALGAE

A certain amount of 'maturing' is to be expected and even welcomed in a newly planted aquarium: it is a healthy condition and the rocks and stones assume an older and more natural effect. The new aquarium sometimes becomes quite cloudy for a day or two (due to the growth of bacterial organisms), but if left alone will automatically clear itself. At times, however, and especially if the tank is in a strong light, an unpleasant green growth becomes apparent on the glass sides or entangled round the plants. This suspended algae growth can be easily kept in check by the regular removal of as much as can be twisted round a rough stick. Pushed into a clump of 'silkweed' and twisted about, the stick when removed will take most of the weed with it. A discarded razor blade attached to a small piece of wood makes an excellent tool with which to scrape the glass aquarium sides. A few Planorbis snails (which seem to prefer algae to more valuable plants) can be introduced, and excessive light cut out in an attempt to prevent a re-occurrence of the trouble.

FEEDING

There is an old saying that more fish are killed by overfeeding than ever died of starvation. This may or may not be true, but it is a safe rule never to give them more food than is absorbed in fifteen minutes. Cold water fish require less feeding than those in warm water, and rations should always be cut down during the winter. The unconsumed portion must be removed with a siphon and not allowed to decay and foul the tank. This is the real cause of many aquarium troubles.

WATER

Once the aquarium is correctly established it is unnecessary to disturb it beyond the regular replenishment of water lost by evaporation, the clearing of dead herbage and the removal (with a siphon) of mulm and other refuse from the bottom.

The absorption of salts from water by plants and fish means that a chemical depletion is taking place unless some means are employed to remedy the loss. For this reason a pinch of Epsom salts and a tiny piece of rock salt should be added every month to the aquarium to prevent chemical exhaustion.

Recently, the effects of acidity and alkalinity on goldfish has

been the subject of extensive investigation, and experiments are being conducted to study the results of these conditions. Known mysteriously as PH value, it pertains to the concentration of hydrogen ions in the water and we are informed that the ideal aquarium PH is 6.8—which is slightly acid. Up to the present too little is known of the matter to make further comment here desirable; we merely mention the subject because sooner or later the reader will certainly come across some reference to PH control in aquatic literature.

The following lists of aquarium plants for cold- and warm-water tanks include the finest oxygenators, the most easily obtainable and the easiest to grow. They are described at length in Chapters IX and X.

COLD WATER

<i>Callitriche verna</i>	<i>Ludwigia palustris</i>
<i>Eleocharis acicularis</i>	<i>Myriophyllum</i> . All species
<i>Elodea callitrichoides</i>	<i>Ranunculus aquatilis</i>
<i>Elodea canadensis</i>	<i>Sagittaria natans</i>
<i>Elodea crispa</i>	<i>Sagittaria pusilla</i>
<i>Elodea densa</i>	<i>Tillaea recurva</i>
<i>Eriocaulon septangulare</i>	<i>Utricularis vulgaris</i>
<i>Hydrocharis Morsus-ranae</i>	<i>Vallisneria spiralis</i>
<i>Lemna</i>	

WARM WATER

<i>Anubias lanceolata</i>	<i>Heteranthera graminea</i>
<i>Cabomba caroliniana</i>	<i>Heteranthera zosteraefolia</i>
<i>Cabomba rosaefolia</i>	<i>Riccia fluitans</i>
<i>Ceratopteris species</i>	<i>Salvinia species</i>
<i>Cryptocoryne species</i>	<i>Vallisneria species</i>
<i>Eichhornia speciosa</i>	

CHAPTER XVIII

Diseases, Pests and other Troubles of the Water Garden

Spawn, weeds and filth, a leprous scum
Made the running rivulet thick and dumb.

SHELLEY

THE LILY pool is no more free from the nuisance of disease, weeds and animal pests, than any other part of the garden; so that a watchful eye should be kept right from the beginning for the earliest signs of such troubles.

Most aquatic plants favour still water, which is conducive and favourable to insect pests and to the rapid growth of weed. Healthy water-lilies, too, when once established, by showing a tendency to thrust the leaves high above water level, allow crawling creatures to remove themselves well beyond the reach of fish in the pool below. This is especially so in the case of black aphides and is best met by using a high-pressure hose which washes the insects off into the water, where the fish make short work of them. It should be realised that the latter are man's greatest allies in the war against weed and insect troubles, and consequently every pool should be adequately stocked.

APHIDES

A reddish-black aphid frequently attacks water-lilies and other aquatics in such numbers as to blacken the surface, causing discoloration and premature decay of the parts affected. The creature involved is known as *Rhopalosiphum nymphaeae*—the water-lily or plum aphid, because it uses both plants as hosts during certain stages of its life history. We have observed such aphides on *Nymphaeas*, *Limnocharis*, *Sagittarias*, *Alisma Plantago-aquatica*, *Aponogeton Krauseanum*, *Nelumbos*, *Cyperus*, *Hydrocharis Morsus-ranae*, *Nuphars*, *Pontederia cordata* var. *lanceolata*, *Limnobium*, *spongia*, and also *Salvinia* (especially when these have been growing very thickly in shallow water and have been forced above the water surface).



A WELL-PLANTED COLD-WATER AQUARIUM



CRYPTOCORYNES MAKE AN IDEAL BACKGROUND FOR TROPICAL FISHES



A FANTAIL GOLDFISH



TELESCOPE VEILTAIL MOOR

The creatures are more troublesome in the greenhouse than outside, and usually put in an appearance during hot, dry weather; appearing first on the stems and spreading from there to the leaves and flower buds. They should be checked at the first onset, when the aim is to destroy the spring migrants (from their winter quarters on the plum); otherwise the rapid growth of stem and foliage renders it extremely difficult to dislodge them. A heavy shower or thunderstorm is a great help out of doors, or the jet from a high-pressure hose will move most. The hosing should be repeated several days running, as some always escape and crawl on to the plants again. In the aquatic house—where the trouble is more prevalent—one often has to resort to fumigation methods. At the nurseries we use Mon Rose Nicotine Shreds, a product of Messrs. Geo. Monro; placing about five small heaps (roughly a handful) at intervals on the floor of a 100 ft. house. Any doors or windows should be shut, all crevices sealed, and the fumigant lighted and allowed to slowly smoulder. This operation should be performed in the evening and the house kept closed until the morning, when the apertures can be opened and the plants syringed to dislodge the dead aphides. This preparation does not destroy the fish life, although water terrapins and such amphibious creatures should be removed.

CADDIS FLIES

Caddis flies are the larvae of *Trichoptera*, a sub-order of *Neuroptera*; and in the adult stage resemble certain of the smaller kinds of moths. They are feeble fliers with two pairs of hairy wings, and fly in the evenings; laying their eggs in or near water. The larvae are practically all aquatic and cover their bodies with different sorts of material—such as sticks, leaves, sand, shells and bits of plants—sticking these together with such marvellous dexterity as to completely disguise their true outline. Incidentally, the material chosen for this purpose and the shape of the dwelling often suggest the identity of the particular caddis fly involved. At this stage, the insects frequently do a great deal of harm to nymphaeas by damaging the roots, leaves or flower buds; biting the young shoots through directly they appear, until the vitality of the plant is completely exhausted. Natural enemies are fish, especially carp, golden orfe and goldfish; and if these are present in the water there is little need for alarm. Hand-picking may be

resorted to in the case of a suspected pond being emptied in early spring.

WATER-LILY BEETLE

The Nymphaea Leaf Beetle (*Galeruca nymphaeae*) is the most destructive of all the water-lilies' enemies, and does considerable damage to the flowers and leaf surfaces. Fortunately, it is of rare occurrence, at any rate we at Enfield have scarcely suffered from its ravages; probably because our tanks are so well stocked with its natural enemies—fish. Dr. Fox Wilson, however, of the Wisley Laboratory, writing in 1928 in the *Journal of the Royal Horticultural Society*, commented on serious infestations during the summer months and noticed that the blossoms of *N. Marliacea albida* were especially selected for attack. The beetle is very small—about twice the size of a ladybird—and is dark brown in colour. Dr. Fox Wilson records that they hibernate in the dense stems of *Aruncus sylvestris* and other waterside plants during November and December and come on to the water-lilies about June. The eggs are laid in clusters on the leaf surfaces and hatch out in about a week. The larvae feeds on the host tissues, and eventually pupation takes place on any part of the leaf that is raised above water.

Remedies consist of syringing the leaves forcibly with clear water, for fish will devour this pest at all stages of its life history. Dead herbage at the waterside should be cut down and burnt during the autumn to destroy any hibernating beetles.

BROWN CHINA MARKS MOTH

The larvae of the Brown China Marks Moth (*Hydrocampa nymphaeata*) sometimes attacks the leaves of nymphaeas and other water plants: feeding upon the soft parenchymous tissues until the foliage is reduced to a brownish, foetid, rotting mass. The moth is quite small (1 to 1¼ in.) with brownish-orange wings which are freely patterned with irregular white patches; and is in evidence during the late summer months. The eggs are laid in small clusters beneath or near the edge of the leaf, and hatch out into cream-coloured worms which feed freely upon the foliage. These eventually pupate, forming silken cocoons within the twisted leaves of taller aquatics, and finally emerge as perfect moths.

The best remedy is flooding: adding so much water that the

nymphaea is completely submerged, when the larvae is either drowned or eaten by fish. Where this is not practicable, the affected plant can be forcibly sunk by laying a round hoop over the crown, thus holding the leaves beneath the surface. The hoop should be left in position for about two days and then removed. Besides nymphaeas, this pest attacks *Potamogeton natans*, *Hydrocharis Morsus-ranae*, *Alisma Plantago-aquatica*, *Limnanthemum nymphoides* and *Aponogeton distachyum*.

FALSE LEAF-MINING MIDGE

Cricotopus ornatus, the False Leaf-Mining Midge, is mentioned by Dr. Fox Wilson as having been found in the Isle of Wight in 1920, where the larvae did considerable damage to some water-lilies by eating narrow serpentine lines all over the leaf surfaces. It would appear to be comparatively rare, and we have never come across the insect at Enfield. The suggested remedy is to spray the foliage with a nicotine wash, used through a fine nozzle so as to give a mist-like spray.

FUNGUS DISEASE

Nymphaeas are also subject to a fungus disease known as *Cercosporae* genus, a leaf spot which causes the edges to dry and crumple up, and spreads so rapidly that the plants soon become denuded of foliage. The best remedy is Bordeaux Mixture, used at half the strength recommended for other plants. It should be applied through a finely-nozzled spray and all parts of the nymphaea be thoroughly wetted. The operation should be repeated on alternate days until the disease is eradicated.

SNAILS

Snails sometimes become a great nuisance in the pool, especially the forms of *Limnaea*. They devour the leaves and flowers, or bite them off and leave them floating about the tank. The easiest way to get rid of them is to place a cabbage stump or small lettuce on the surface of the water overnight; leaving this until next morning, when it will be found thickly covered with snails and can be removed. If the operation is repeated for two or three nights the nuisance is usually disposed of.

RATS AND MICE

The water rat or vole sometimes attacks water-lilies in natural lakes, destroying the roots or eating out the hearts of the flowers. Trapping and shooting are the only remedies. Rats and mice will also devour the tubers and seeds of tropical nymphaeas stored for the winter; so that precautions should be taken to keep these stocks in a safe place.

WEEDS

The greatest of all troubles that beset the water-lily grower are weeds, especially the hairy, tangled masses of *algae*, known as Silk or Blanket weeds. These grow so rapidly under favourable conditions as to completely envelope the plants, choking the life out of them and destroying the appearance of the pool. The commonest causes of trouble are high temperatures, excessive light, or a super-abundance of manure in the soil.

Most ponds shortly after planting show a tendency to become greenish or cloudy; the same phenomenon also being apparent in early spring. This is due to the great chemical changes that are taking place and to the growth of bacterial organisms, which are gradually causing the water to become matured. If left alone the condition automatically rights itself in a week or two, especially as the submerged aquatics get going and exercise their oxygenating powers. It does more harm than good to change the water, for the process of transmutation is then only retarded.

Apart from such natural causes, when excess light is the cause of the trouble, natural shade can be afforded by the floating pads of the water-lilies and Aponogetons or by any of the floating aquatics. They must not be overdone or the other plants in the pool will not receive sufficient light. Algae thrives on salts dissolved in the water, but once the submerged aquatics are thoroughly established these take precedence, so that the Blanket weeds come off second best and generally begin to fail. Goldfish, too, being mainly vegetarians, eat the weed with avidity, and so will *Paludina vivipara*, the freshwater winkle.

Chemical methods are sometimes advised in obstinate cases, but these are so dangerous and it is so simple to use too much and thus kill all plants and animal life in the pond, that we do not really recommend their use. Copper sulphate crystals are most generally employed, and are often used at waterworks—in the reservoirs

and storage tanks—for their value in controlling *algae* growth in water. The proportions involved in these cases are roughly 2 to 4 parts copper sulphate per million of water: which is really too strong to use in the ordinary pond containing fish and plants. Here, 23 grains is sufficient for a pond of a thousand gallon capacity, and the crystals should be placed in a small muslin bag tied to the end of a stick, and slowly drawn through the water. The operation is best performed in the evening. At the nurseries we never use this method, but have been experimenting recently with powdered lime. This forms a voluminous precipitate in the water and carries down the suspended *algae* growth to the bottom of the pool, where it can be siphoned off. Unfortunately, it often spoils the nymphaea leaves as well, although these will in time recover, and makes the water so intensely alkaline as to upset the fish.

Permanganate of potash gives very effective control and is moderately safe to use even in the pond containing fish as well as plants—only the youngest fry will suffer. A saturated solution should be prepared and one teaspoonful used to each gallon of water in the pool. Apply this directly after planting to control the *algae* in its initial stages and the treatment can be repeated during the growing season as necessity arises.

A curious phenomenon that we have noticed is the almost complete absence of *algae* in pools which are adequately stocked with *Nitella*, *Chara*, or the Ivy-leaved Duckweed (*Lemna trisulca*). Unfortunately, the first two are liable to get out of hand unless occasionally thinned out, but we know of a lake which contains no oxygenating aquatics but *L. trisulca*, and, except for a brief period in early summer—when the fronds rise to the surface for fructification purposes—the water is always crystal clear. Undoubtedly water conditions play a great part in the determination of *algae* growth, and there is much room for experimenting. Recently, sodium aluminate and phosphoric acid have been used for the chemical clearance of green water in aquariums, but, although they apparently act for a time, we do not believe such methods to be advisable as they throw the chemical status completely out of adjustment and only cause other troubles later on.

The safest method is to balance the pool sensibly with fish, underwater oxygenators and nymphaeas, and remove the thread *algae* (the sort which entangles everything) by hand. This can be

done by means of a handnet, or by twirling a long, notched stick in a circular motion amongst the weed, when it will draw most of it away.

Daphnia will also clear the water—if no fish are present.

Sometimes, directly after planting, a greenish scum forms on the surface of the water. This can be removed by adding more water, so that the pool overflows, or by drawing a sheet of newspaper across the surface. With a large area, a vigorous hosing (pressing the nozzle end tightly together between the finger and thumb) causes a deal of the precipitate to sink to the bottom, whilst the rest collects in a corner and may easily be removed with a handnet.

SUPERFLUOUS UNDERWATER VEGETATION

Sometimes the oxygenating aquatics for a large pool or lake have not been happily chosen, with the result that the whole bottom becomes thickly covered with *Elodea canadensis* or *Potamogeton* as the case may be. The only sure way of eradicating this is by emptying the pond and replanting, failing which the weeds must be periodically cut.

A useful tool for the outdoor pool, suitable for cutting away dead nymphaea leaves, old flower heads, etc., can be simply manufactured at home. Procure a very long bamboo cane, and bore a hole right through it at about an inch from the end. Next, split the cane 2 in. from the end, so that the hole is roughly in the centre and in it place a razor blade, screwing this into position by means of a small bolt and nut through the blade and cane. The blade can be renewed when necessary.

CHAPTER XIX

Fish and Scavengers

NO POND or lake capable of supporting water plants can be termed a complete success without its complement of fishes, not only for the life and beauty they add to the garden, but for their great services in keeping down insect life in the larval stages. Mosquitoes need water in which to deposit their eggs, which are laid in vast numbers on the surface. These eventually hatch out into wrigglers and thence by rapid stages to *pupae* and flies, forming valuable fish-food at all stages of growth. As they are the carriers of so many germs, the owner of a pond is morally responsible to his neighbours to see that mosquitoes shall not breed in his garden: by placing a few fish in the pool he is secure from all risks. Only such sorts should be selected as will not attack plants or stir up the mud; they ought also to be bright and interesting in appearance, and live in harmony with their neighbours. Such a description most aptly fits the goldfish, a hardy, easily tamed creature of quiet habits and reasonable cost.

Fish should never be introduced to an immature pool; the presence of free lime which dissolves into the water from new concrete causes their fins to split and fray, often causing death. The condition can be remedied by adding a neutralizing agent, as described in Chapter II, but the safest plan is to wait until the plants have become well established before putting the fish into the water at all.

Fish like a shady spot to resort to when the sun is hot: in a well-clothed pool this is naturally given by water-lily leaves or the foliage of other plants, in the aquarium it can be provided by floating aquatics.

Outdoor fish-feeding is usually a simple problem, for generally there is plenty of natural food in the way of insects, algae, worms, etc., already present in the pond. Small white worms, known as *enchytrae*, form excellent food; a supply is quickly obtained by placing a few in a breeding-box of soil (covering the surface with a piece of glass to prevent evaporation), and feeding them on sour milk, fat, cooked oatmeal and other such substances. Fish greatly

relish this live food, as they do chopped earthworms and bloodworms (*larvae* of the chironomus fly). *Infusoria* is prepared by placing a lettuce-leaf in water and leaving it for a few days, when quantities of small creatures will appear; it is excellent for pool fishes in the fry stage and also tropicals. Another method is to put a handful of hay in a pail, covering this with boiling water, and later, when it cools, filling it to the brim with cold water, then standing the pail in the shade. A pint or quart of this liquid is then added to the pool or aquarium contents, and a corresponding amount of fresh water added to the culture. A banana skin placed in rain water with a teaspoonful of fresh milk likewise produces infusoria.

Daphnia, commonly known as water fleas, undoubtedly form the finest live food, especially for tropical fishes. They are found in ponds and exposed water where heavy decomposition of animal and vegetable matter is taking place. During spring and summer the creature is parthenogenetic, reproducing in incredible numbers; but at the approach of cold weather males appear and winter eggs are laid. Water fleas are easily caught with a hand-net, but if taken from a wild pond should be screened several times (to eliminate enemies) before being added to the fish pond. They can be reared in a tub containing some garden soil with a small teaspoonful of bonemeal added, but the water must never become acid (at the first signs of its doing so a pinch of bicarbonate of soda should be added) or the fleas will stop reproducing.

There are also many dried foods on the market, a proprietary brand of aquarium fish meal being as good as any. Dried shrimps, dried daphnia and special concentrated mineral foods can be obtained, and given in turn with live food provide a welcome variety in diet.

During the winter less feeding is necessary, for this is the natural resting period of fish and they become sluggish and rest at the bottom. All this time they live upon their own food reserve; so that it is not so much the winter period that is a critical one for fish, but those early spring months when food is scarce and the body resources taxed to the utmost. The unfortunate fish which has little nourishment stored up becomes very wasted in spring and highly susceptible to disease: but, if well nourished and with something in reserve, then he is enabled to carry on until plentiful supplies of live food appear in the late spring months. To avoid

disease and so lessen the high death-rate which occurs every year in well-stocked tanks, establish the pool early in summer and feed the inmates vastly to prepare for winter fasting. In the event of freezing, a hole should be kept broken in the ice to allow of some surface absorption of oxygen.

As regards the best fish to keep in ponds, it should be noted that the brightly-coloured ones give the most pleasure, for no matter how attractive or interesting some of the sorts are, it is not much good if they cannot be seen. It is therefore advisable to stock the pool with gold and silver orfe, goldfish, golden rudd, hi-goï, golden tench or any of the fancy varieties of goldfish.

GOLDFISH (*Carassius auratus*)

The common goldfish is supposed to have been first introduced to this country from China about the year 1611. It is a near relative of the common carp and varies greatly in colour, from red, yellow and pearly-pink to jet-black. Easily tamed, it is not too active, is perfectly hardy and associates well with other fish.

FANCY GOLDFISH

These beautiful varieties are evolutions of the Japanese, who have devoted much time and labour to producing colourful and attractive variants of the ordinary goldfish. Generally they are not as hardy as their common ancestors so should be placed in the indoor aquarium for the winter. The Fantails as a rule have a thicker and stumpier body and a threefold, fanlike tail. In the Veiltail or Fringetail these characteristics are even more marked and the tail hangs down like a long skirt, much impeding the swimming process. The body is deeper too than that of the Fantail and the dorsal fin so high that it droops.

Nymphs are sports from Veiltails, having similar bodies and fins but with a single tail, which is held straight out and may or may not be forked. The Telescope is so called from its extraordinary protruding eyes which stand well away from the head, whilst the Celestial has similar eyes, but pointing upwards instead of sideways.

The Shubunkin or Calico Fish, bred by the Japanese in 1900, has proved quite hardy in this country and is much in demand because of its bright and attractive colouring. The true Shubunkin is practically scaleless and is red, white, black and purple with

heavy bluish and reddish dapplings. Skilful Japanese breeders have produced still another interesting variety. This is the Telescope Moor, which is of a deep velvety black with protruding eyes: sometimes veiltailed as well. The slightest touch of bronze in the blackness shows that the fish is not pure bred: the finest ones even have black eyes.

The Lionhead has a round body, no back fin and a warty growth all round its head. Having only a very short tail, swimming is an uneasy process: at the best of times this fish is a difficult one to rear, so is not suitable for the amateur.

The Oranda is the result of a cross between a Lionhead and a Veiltail. It has the fins and general shape of the latter parent and the warty growth of the former.

The Comet is the fastest swimming and most graceful goldfish known, and quite hardy in the outdoor pool. It retains the original goldfish shape, but the fins and tail are greatly elongated, which gives it a 'streamlined' appearance.

Veiltails (Fringetails), Moors, Lionheads, Celestials and Telescopes are not suited to outdoor life, preferring comparative warmth (min. 65°) indoors; they are therefore only adapted to an aquarium existence.

ORFE (*Leucisus orfus* and *L. argenteus*)

Golden and silver Orfe are valuable assets to the outdoor pool and particularly suitable to use in conjunction with goldfish. Being more fond of surface feeding than the carps, they are generally visible, and swim about the pool in shoals. With their long, narrow, streamlined bodies, flecked with brown on silver or gold (as the case may be), they are handsome and active, darting across the water at great speed. Orfe are less subject to disease than most fish and quite hardy: they rarely breed in this country however.

GOLDEN TENCH (*Tinca tinca* var. *aurata*)

A golden variety of the common green tench (*Tinca tinca*), this is a beautiful fish, but unfortunately rarely seen because of its inclination to remain at the bottom of the pool. It attains a good length, is quite hardy and lives to a good age.

The Common Carp (*Cyprinus carpio*) is sometimes introduced to the large pool or lake, and whilst not as attractive as some has

the advantage of being so easily tamed that it will take food from the fingers. Leather Carp, Mirror Carp and King Carps, although sombre-coated and of sluggish habits, are also occasionally used as pond fish: they are too large for the aquarium.

The Bitterling (*Rhodeus amarus*) is one of the smallest of European fishes, the male being about 3 in. and the female only 2 in. long when fully grown. During the breeding season the male assumes handsome hues, the sort of coloration one gets with an oily patch on a wet road, for which reason it is sometimes known as Rainbow Fish. The eggs are either deposited inside the shell of the freshwater mussel, or drift in—the point is not quite determined—and hatch out inside the host. This fact should be borne in mind if one wishes to breed Bitterling, and a stock of mussels should be laid in in readiness.

Golden Rudd (*Scardinius erythrophthalmus* var. *aurata*), often confused with the roach, is far handsomer, with a bronzed-copper body and scarlet fins, tail and eyes. It associates well with other fish and may safely be introduced to the outdoor pool.

Sticklebacks, catfish and sunfish are too pugnacious to place with other fish, nor are they as colourful as those already described.

SCAVENGERS

Scavengers being the 'dustmen' of the pool are there to devour waste animal and vegetable materials which otherwise would foul the tank; fish-excreta, confervae, remnants of fish food and dead insect life are their natural prey and by ridding the aquarist of such refuse they render him a great service. At the same time, it is wrong to suppose that all freshwater snails and mussels are so obliging, for, unfortunately, a few will attack plants or are carnivorous. A case in point is *Limnaea stagnalis*, the Freshwater Whelk, a most prolific brute with a long, pointed shell and a nicety in taste for the rarities of the plant world. Sometimes he is introduced to the pool by accident—as through the jelly masses of eggs being present on the back of a water-lily leaf—so that before one is hardly aware of their presence there are dozens of young *Limnaeas* in the pool. A good way of getting rid of them is to place a lettuce or cabbage stump on the surface of the water at night: next morning it will be covered with snails. If the operation be repeated several nights running they should be kept down quite easily.

The finest snails to introduce are the Ram's Horns and the Freshwater Winkles; both these genera seem to feed upon convolvuloid growth in preference to any other, and will live equally well in still or slow-running water.

There are eleven species of the genus *Planorbis*—the Ram's Horn Snail—in this country, but the one most easily obtainable is *P. corneus*, with a black body and a flat, coiled shell. A variety with a reddish-crimson body, *P. corneus* var. *rubra*, is also obtainable and becomes more decorative for aquarium purposes.

Paludina vivipara (Freshwater Winkle) has a round, winkle-like shell and a black and yellow spotted body with a lid or operculum over the mouth of the shell. It does not lay eggs, but produces its young alive and feeds almost exclusively on decaying vegetation.

Mussels are excellent scavengers, but one hesitates to recommend their indiscriminate use owing to the amount of oxygen such a large creature consumes. This is more noticeable in the small pool or aquarium, where, should one die it is likely to poison the rest of the tank unless discovered at once. Often this is difficult, as the mollusc remains on the bed of the pool, where it also causes damage by uprooting plants in its travels over the ground. The Swan Mussel, known as *Anodonta*, is the one usually stocked by aquatic dealers.

FISH DISEASES

Like all other forms of organic life, fish are subject to illnesses and diseases, and, unless these are treated in the very early stages, our present lack of knowledge makes it extremely improbable that they will ever recover. Prevention is better than any cure, and proper feeding, unpolluted water and well-planted and matured ponds are the greatest guarantees against infections. Fish should always be carefully handled: having no eyelids, these organs are easily damaged; rough treatment, even the texture of a too coarse net often causes temporary or even permanent blindness. Bruising has far-reaching effects; some knocks are often worse than cuts and go deep into the muscles and tissues with fatal results.

Decaying water plants or food debris, improper or overfeeding and sudden changes of water temperature are other factors which encourage such troubles, whilst parasites and infection are sometimes introduced with wild plants from a natural pond.

DIGESTIVE TROUBLES

Constipation and indigestion are common troubles where improper feeding is practised, but, fortunately, such conditions can usually be cured. The best remedy is to add small quantities of epsom salts to the water, or, in bad cases, pour a few drops of castor oil down the throat of the affected fish. The dose should be repeated if necessary and a meal of chopped earthworms and duckweed given afterwards.

FUNGUS

This, the commonest and most dreaded disease which attacks fish, is particularly prevalent with the fancy varieties of goldfish. It is due to a fungus (*Saprolegnia ferox*) which roots itself in the muscle of the fish and is apparent by the 'cotton-wool' like inflorescence which develops on the outside of the skin. The fungus also grows in decaying animal matter, from which it spreads to the fish—generally through a bruise or wound. Several remedies are practised, the most usual being to immerse the fish in sea water, if this is available, or, failing this, in a very strong salt solution. The fungi is wiped off with cotton wool and the fish left in the salt bath until it shows signs of distress. Experiments have also been effective with kerosene, dropping the fish into the oil for $4\frac{3}{4}$ minutes when they have been apparently quite cured. Miss Ida Mellen, of the New York Aquarium, writing in the Society's Bulletin in 1928, gave the following interesting notes on fungi. 'In the case of fungus on freshwater fishes of large size such as carps, buffalo fishes and giant gars, it is an old practice at the New York Aquarium to introduce small fishes into the tank to eat off the fungus. Sunfishes, roach and goldfishes do this work well, and giant gars left unmolested a company of pearl roach engaged in ridding them of *Saprolegnia*.'

Should fungus attack all the fish, it is as well to empty and disinfect the pond or aquarium with a strong solution of permanganate of potash.

WHITE SPOT

This disease is caused by a parasite *Ichthyophthirius multifiliis*, which imbeds itself in the skin of its host and manifests itself by small white specks which rapidly spread all over the body. The parasites, when mature, drop to the bottom of the pond or

aquarium, where the spores break out in a few days and seek a fresh host. Thus the fish is sometimes clear of the trouble for a while, but in a few days appears to be worse than ever. The disease is not manifest in running water, which washes the parasites away, so that, if the victims can be transferred to moving water for a few days, the trouble is usually disposed of. When this is not practicable, the German method of heated water often gives satisfactory results. The fish should be placed in warm water (heated gradually to 85-90 degrees), and transferred to fresh receptacles at eight-hourly intervals. The cure usually takes two to three days. Five to ten drops of a $2\frac{1}{2}$ per cent. solution of mercurochrome added to each gallon of water in an affected aquarium usually effects a cure in two to three weeks. The chemical colours the water deep red, and after a week about a sixth of the bulk may be removed and replenished by fresh water, the operation being repeated at intervals until the aquarium is naturally clear again.

SWIMMING BLADDER TROUBLE

Fancy goldfish, owing to their peculiar body distortions, often suffer from swimming bladder trouble, a disorder which arises through incorrect feeding and digestive troubles, and causes loss of equilibrium, so that the fish is incapable of swimming in a normal position and becomes most erratic in its movements. The victims rarely recover, or, if they do, are susceptible to further attacks. Some relief may be obtained in the early stages by placing the fish in a shallow bath at a temperature of 65-70 degrees. Chopped earthworms, duckweed, and a few grains of epsom salts or one of the proprietary rectifiers may be administered.

ARGULIDS

Fish lice are small crustaceans easily visible to the naked eye, which attach themselves to the gills or other body parts, causing great distress to the fish. They may sometimes be removed with a pair of forceps, or the effect of touching the argulid with a drop of paraffin or turpentine causes it to drop off. The parasites are usually introduced with plants, which is another reason for exercising care when adding wild plants to the pond or aquarium.

INJURED EYES

The telescope goldfish in particular sometimes suffers from sore eyes, caused by a knock or a blow. Swabbing with a boric acid solution usually effects a cure in about a fortnight.

There is a parasitic development sometimes observed in goldfishes which renders the corneal surface opaque. If taken in time this yields to a treatment which happens to be excellent for bad cases of damage also. Two or three drops of a solution consisting of two parts tincture of iodine to ninety-eight parts of glycerine are allowed to drip right on to the eye, holding the fish the while in the wet net. This treatment is repeated twice daily until the eye has recovered. If the tissues of the eye become penetrated either as a result of the parasitic attack, or by fungus subsequent to a wound or other damage, no recovery can be anticipated.

OTHER ENEMIES

The larvae of the Dragon Fly and adult and larvae of the Predaceous Diving Beetle (*Dytiscus marginalis*) will at times attack fish and wound them cruelly. They must be hand sought and removed.

APPENDIX

How to calculate the Gallon Capacity of a Pool

MULTIPLY THE length by the breadth by the depth (inside measurements) to arrive at the cubic capacity of the pool in feet.

Multiply this sum by $6\frac{1}{4}$ and the resultant sum gives the number of gallons in the pool.

1 gallon of water weighs 10 lb.

1 cubic foot weighs 62.5 lb.

1 cubic foot therefore = $6\frac{1}{4}$ gallons.

Thus, a pond measuring 6 ft. by 4 ft. and 18 in. deep holds 225 gallons of water.

$$6 \text{ ft.} \times 4 \text{ ft.} \times 1 \text{ ft. } 6 \text{ in.} = 36 \text{ cubic feet.}$$

$$36 \text{ cubic feet} \times 6\frac{1}{4} = 225 \text{ gallons.}$$

Addenda

As a guide to the amount of material required to construct an average pool:

A pool, size 9 ft. long by 6 ft. wide by 2 ft. deep inside; with 6 in.-thick bottom and sides, and a surrounding trough (as shown in Fig. 1) 12 in. wide by 6 in. deep (inside measurements), with 4 in.-thick bottom and sides, will require about 3 cubic yards of concrete, about one square (100 square feet) of boards for shuttering and will contain about 700 gallons of water.

For each foot in length, added to or deducted from the length of a similar pool (providing that it is also 6 ft. wide), add or deduct about $6\frac{1}{2}$ cubic feet of concrete.

It cannot be accurately stated how much cement, sand and aggregate will be required to make a given quantity of concrete, as, according to the type of aggregate used, varying amounts of sand will be required to make a compact mixture. As a rough guide, about $1\frac{1}{4}$ cubic yards of sand and aggregate will be needed (apart from the sand) to make one cubic yard of concrete.

Thus, in the proportions specified, viz., 1 part cement, 2 parts

sand and 2 parts of aggregate; a cubic yard of concrete will require 9 cubic feet of cement to 17 cubic feet of sand and 17 cubic feet of aggregate.

Therefore, to construct the pool whose measurements are given above, the following materials will be needed:

3 yards of concrete
or 21 cwt. of cement
 $1\frac{7}{8}$ yards of sand
 $1\frac{7}{8}$ yards of aggregate.

Memoranda

To calculate the amount of concrete required for varying shapes and sizes of pools.

1 cubic yard of concrete will cover 54 sq. ft. of wall or floor to a depth of 6 in., or, 81 sq. ft. to a depth of 4 in.

1 cubic foot of cement weighs 90 lb. Cement is supplied in 1 cwt. bags.

GLOSSARY OF SOME BOTANICAL TERMS

- Aerenchyma*, respiratory tissue formed by the phellogen (bark).
Alternate, the arrangement of leaves on a stem when they alternate from side to side.
Amphibious, plants which can live equally well in water or on land.
Annual, a plant which rises from the seed, flowers, and dies the same year.
Anther, the top of the stamen which contains the pollen.
Apetalous, having no petals.
Apex, the point farthest from the point of attachment.
Axil, the upper angle formed by the union of a stem and leaf.
Axillary, placed in an axil.
- Biennial* plants spring from the seed in one year, flower in the following year, and then die.
Bifid, divided half-way into two parts.
Bipinnate, when the divisions of a pinnate leaf are themselves pinnate.
Bracts, small leaves at the base of a flower stalk.
Bulb, a leaf-bud with fleshy scales, usually underground.
- Calcifuge*, lime hater.
Calyx, the outer whorl of leaf-like organs (sepals) comprising the flower, usually green.
Capillary, like slender threads.
Capitate, round like a head.
Capsule, a dry seed vessel.
Carpel, the divisions of the ovary or capsule.
Cordate, heart-shaped.
Corm, a solid bulbous root (not scaly), as *Crocus*.
Corolla, the inner leaves or petals of a flower.
Corymb, a raceme in which the flower stalks become gradually shorter as they approach the top, so that all the flowers are on a level.
Cotyledons, seed leaves.
Crenate, scalloped at the edge.
Cyme, a form of inflorescence in which each successive branch ends in a flower.

Decumbent, lying on the ground, but tending to rise at the end.

Deltoid, shaped like an equilateral triangle.

Dentate, with small teeth pointed outwards.

Dichogamy, ripening of the sexes at different times.

Dioecious, male and female flowers on different plants.

Disc, a flattening of the receptacle above the ovary, also the centre of a head of flowers in *Compositae*.

Elliptic, egg-shaped but tapering equally at both ends.

Emerged, rising above the water.

Endosperm, the nutrient tissue inside the seed.

Epidermis, the cuticle or skin of a plant.

Epiphyte, a plant which clings to another for support, but is not a parasite.

Farina, a mealy powder.

Fasciculate, when several similar parts are collected together in parcels or bundles.

Filament, the stalk of a stamen.

Filiform, thread-like.

Footstalks, the stalks of either flowers or leaves.

Fronde, the leaf of a fern.

Fructification, all those parts of a plant which comprise the flowers and fruit.

Furcate, forked.

Glabrous, perfectly smooth.

Glaucous, covered with a bluish-green bloom.

Globular, round or spherical.

Glume, the chaff or scales of grasses.

Hastate, halbert-shaped, with two lobes projecting at the base.

Herbaceous, the parts of a plant which are not woody and die down each year.

Hirsute, rough, hairy.

Hydrophyte, water plant.

Inflorescence, arrangement of the flowers.

Internode, the division between two nodes.

Involucre, a whorl, usually applied to the bracts which surround the flowers of *Umbelliferae*.

Labellum, the terminal segment of the lip in Orchids.

Lamina, the broad part of a leaf.

Lanceolate, lance-shaped.

Lateral, on one side.

Linear, very narrow, with the edges parallel.

Lobe, portion of a divided leaf (not compound) or stigma.

Macrospore, the larger of two kinds of spores borne by a plant, usually giving rise to a female prothallium.

Membranous, having the texture of a membrane.

Monocarpic, once-fruiting.

Monoecious, with male and female flowers on the same plant.

Monotypic (genus), with one species.

Node, a joint in a stem from which a leaf springs.

Offset, a short runner bending up at the end.

Orbicular, round.

Orifice, an opening.

Ovary, the lower part of the pistil containing the ovules.

Ovate, egg-shaped.

Ovule, the young seed.

Palmate, divided into five or more narrow lobes, spreading like the palm of the hand.

Panicle, a compound raceme.

Pappus, the feathery appendage of a seed.

Parenchyma, the parts of a plant which consist of cellular tissue only.

Parthenogenesis, development of fruit without fertilization.

Pellucid, transparent.

Pedicel, the branch of a peduncle.

Peduncle, a flower stalk.

Pectinate, divided like the teeth of a comb.

Pendulous, drooping.

Perfoliate, having the stem passing through a pair of leaves.

Perianth, the envelope which surrounds the flower, usually applied when the calyx and corolla are indistinguishable.

Petal, the divisions of the corolla.

Petaloid, like a petal.

Petiole, the leaf-stalk.

Pinnae, the segments of a pinnate leaf.

Pinnate, the leaf is so called when it is divided into numerous segments, arranged on opposite sides of a common stalk.

Pistil, the fertile organs of a flower, consisting of the stigma, ovaries and style.

Plume, a feathery inflorescence.

Pollen, the fertilizing dust contained in the anthers.

Procumbent, lying on the ground.

Protoplasm, the living substance of the plant.

Pubescent, downy.

Raceme, a spike with stalked flowers: hence

Racemose, flowers arranged in a raceme.

Radical, spring from the root.

Reniform, kidney-shaped.

Reticulate, forming a network.

Rhizome, a prostrate more or less subterranean stem, usually thickened and producing roots and leafy shoots.

Sagittate, arrow-shaped.

Scape, a flower stalk springing direct from the root and bearing no leaves.

Sepals, the divisions of the calyx.

Sessile, without a stalk.

Sheath, the lower part of the leaf that surrounds the stem.

Sinus, the bay re-entrant formed between the lobes of leaves or other flower parts.

Spadix, a succulent spike bearing many closely packed, sessile flowers.

Spathe, a large bract enclosing a spadix.

Spathulate, spoon-shaped, oblong but widening towards the end.

Spike, a long, simple stalk with many simple, sessile flowers.

Spikelet, the small group of flowers in Grasses and Cyperus, enclosed within one or more glumes.

Spore, the seed-like reproductive bodies of flowerless plants.

Spur, long, horn-like appendages produced by flowers or leaves.

Stamen, the male organ of the flower, consisting of a filament and anther, which contains the pollen.

Staminate, male.

Stellate, star-like.

Stigma, the summit of the pistil.

Stipule, an outgrowth at the base of the leaf-stalk, usually green.

Stolon, a rooting shoot.

Stomata, minute breathing pores in the skin of plants.

Subcordate, nearly cordate.

Submerged, beneath the water.

Style, the space between the ovary and stigma.

Tendril, a twisted stalk bearing neither leaf nor flower.

Trifoliate, leaves in threes, as Clover.

Tuber, a thickened underground rootstock.

Tunic, a leafy wrapping as in Onion.

Umbel, an inflorescence with many stalked flowers springing from one point and all reaching the same level.

Undulate, wavy.

Viscous, clammy.

Whorl, three or more leaves or other organs arranged in a circle around an axis.

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ವ.ಸಂಖ್ಯೆ:.....

ಗ್ರಂಥ ಹಿಂದಿರುಗಿಸುವ ದಿನಾಂಕ ಬಿಡು

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ಮ.ತಿ.ನೋ..

ಪ. ಸಂಖ್ಯೆ _____

ಪ. ಸಂಖ್ಯೆ 1197

ಲೇಖಕ (ಕಿ) Perry

**ತೋಟಗಾರಿಕೆ ಇಲಾಖೆಯ
ಗ್ರಂಥಾಲಯ**

ಲಾಲ್‌ಬಾಗ್, ಬೆಂಗಳೂರು-560 004

